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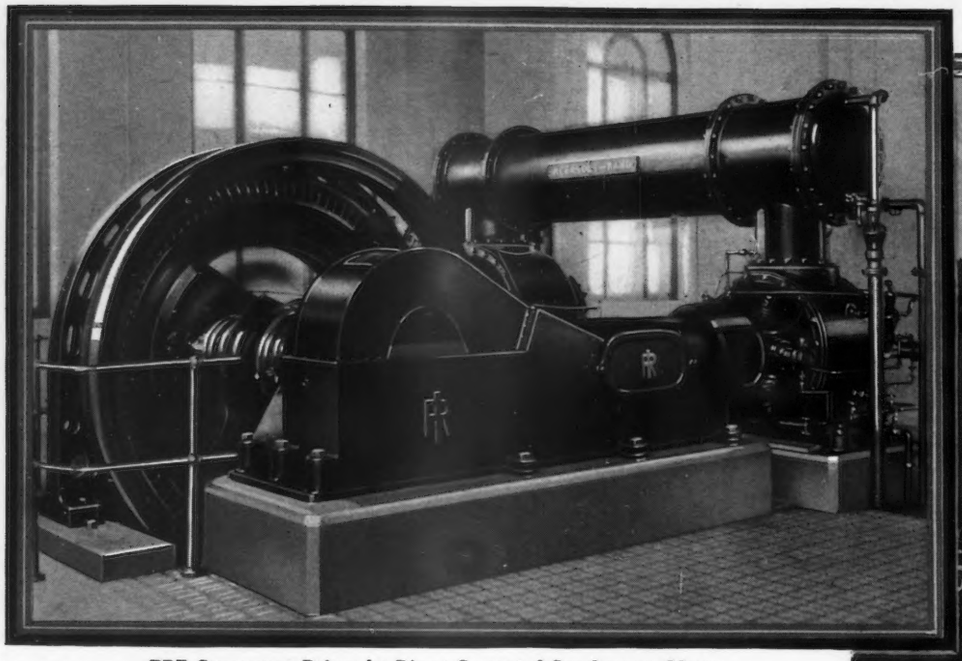

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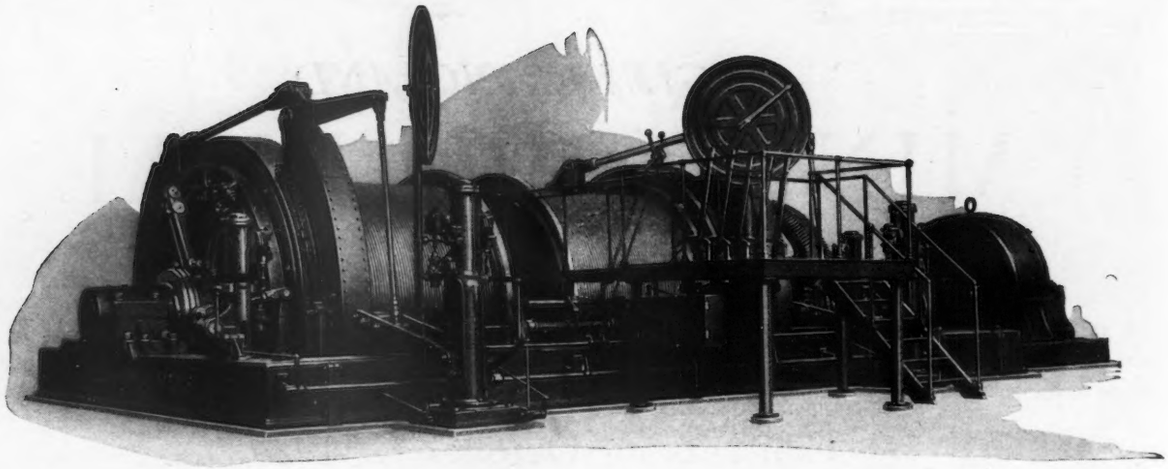

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ENGINEERING AND
MINING JOURNAL

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He That Will Not Apply New Remedies Must Expect New Evils—*Sir Francis Bacon*

AN ENLIGHTENED COUNSEL that recommends fruitful co-operation in place of wasteful competition has at last made itself heard in the parliaments of the nations. Secrecy has been disclosed as a reprehensible and a dangerous phase of diplomacy and propaganda. In its place has come a demand for the frank and open discussion of problems that affect world welfare. No longer is the student of international affairs alert with apprehension, or keeping his ears to the ground—to detect rumblings. Instead, he travels, unearths the truth, discovers that the business of a certain type of nationalist is to make a mountain out of a molehill, and realizes that the various elements comprising the civilized world are merely out of step in their march toward the common goal of group industrial efficiency and mass self-respect.

The mining industries of the leading producing countries of the world in recent years have been drawn closer together by reason of the fact that the major problems arising have been technical, and capable of general interpretation. An engineering innovation in any one region is of significance to consultants and operators in other regions. Of major concern is the question of technical efficiency at low unit production cost—an ideal that has been kept to the front as a major objective in the plans and policies of *Engineering and Mining Journal*.

This mouthpiece of the mining industries, however, in its zeal to serve, has sought and welcomed broader responsibilities—in contribution to a greater diffusion of knowledge and a more widely distributed prosperity. An exhaustive survey of its rapidly expanding world field has disclosed a condition that would, if not corrected, restrict the expansion of a service that readers have become accustomed to expect.

Engineering and Mining Journal market news and price quotations have met with general acceptance. They are acknowledged as essential to the proper functioning of the buying and selling branches of the industry, but their ever-widening indorsement discloses a condition of unbalance, because of the increased use of an engineering magazine, as a vehicle of detailed market information, by many who are concerned only with prices and price tendencies. Moreover, the continuance of customary practice has been responsible for delayed release of such information. Promptness in issuance is impossible if market news, of immediate significance, is included among the contents of a technical journal, the planning, editing, printing, and binding of which consume the labor of days, in some respects of weeks.

Engineering and Mining Journal has met with a wide reception outside the country of its origin. This, though acceptable as a recognition of merit, has involved additional responsibility, which necessitates careful attention to the problem of adjusting the service to meet the needs of a clientele the members of which are diversified as to geographical boundaries but classifiable as to technical and market requirements. The need for strengthening international contacts is plainly evident, to insure complete editorial coverage, despite the rapidity with which new areas of interest are being discovered and exploited, and to encourage friendly relations and reciprocity between engineers of different nationalities, as contributing to social and industrial well-being and to world peace.

Efficient journalism, in common with efficient mining and metallurgical operations, makes constant change imperative in an effort to avoid waste and to eliminate the unnecessary. Group publishing effort, with a spreading of the cost, is the logical solution of the problem of providing an adequate service at the lowest possible charge to subscribers. Therefore, to meet the new conditions, a significant expansion of service will go into effect after January 1, 1930, when an exclusive and separate weekly price periodical will be launched under the name of *E. & M. J. Metal and Mineral Markets*. The divorce from the parent publication of this specific and detailed service to the buyer as well as to the seller of the products of the mining industries will permit prompt publication and distribution of last-minute information and comment on market conditions—forty-eight hours ahead of the present schedule. The logical expansion of this service into the buying field, with opportunity for encouraging the wider use of metals and minerals, will permit a low yearly subscription rate of $2 within the United States.

The segregation of detailed marketing information from technical data of timely significance, but not of urgent moment to the consultant or executive or operator, makes the weekly issuance of *Engineering and Mining Journal* no longer necessary. It permits an alteration in the publishing schedule that has long been suggested—one that will be welcomed by readers. After January 1, 1930, *Engineering and Mining Journal* will be issued at semi-monthly intervals—a change that will provide opportunity for a more deliberate treatment of its contents. Improvements and refinements in preparation and presentation will be introduced to permit greater condensation of essential data, technical as well as economic—metal, mineral, market. The magazine will cover the same ground that has been covered for over three-

score years, with added emphasis on international progress in mining and metallurgy. It will be edited especially to serve the reader in the United States and its possessions. The subscription price to him of the new *Engineering and Mining Journal* will be $4 per annum—a reduction of one-third.

In addition, a new monthly magazine, *Engineering and Mining World,* will serve readers in all countries other than the United States and its possessions. Technically, it will cover the identical field covered in the past and to be covered in the future by *Engineering and Mining Journal,* with the omission or condensation of matters of merely local interest to United States readers. A radical reduction in cost to subscribers outside the United States will be possible. The yearly rate for *Engineering and Mining World* will be $4 in the Americas beyond the United States, and $5 in other countries, as compared with an existing subscription rate for *Engineering and Mining Journal* of $7.50 in the Americas outside the United States and its possessions, and $10 elsewhere.

The proposal now disclosed is the result of elaborate surveys and contacts extending over two years, in the United States and abroad. It comes as a necessary evolution in publishing technique, designed to meet the insistent need of the times—for brevity, comprehensiveness, reliability, inspiration—linked with a demand for greater promptness in the release of quotation figures and market information. A more comprehensive service is to be provided at a cost to the subscriber that is made possible only by group publishing, by a division and spreading of production costs.

The publishers and the editorial staff hope and believe that, having gained the respect and confidence of the readers of *Engineering and Mining Journal,* they may continue to look forward to the support and co-operation of the various elements of the industry—executive, technical, manufacturing—in the successful consummation of the new publishing program here announced.

Copper Supplies Ten Years Hence

THOSE who follow the copper industry are intensely interested in Northern Rhodesia. Many Americans have gone over there; and, when one of them returns he must recount his impressions to friends and colleagues, in public and private. Articles on the subject in *Engineering and Mining Journal* are eagerly read. Itinerant mining engineers who have not been to Africa are "rarin' to go." Arizona, Utah, Montana, and Chile must, at least temporarily, take a back seat so far as interest goes.

But it is not from the technical standpoint that central Africa is so absorbing: no particular mining problems are expected, nor is the metallurgy difficult, if our Bwana M'Kubwa friends will pardon such a general statement. It is from the economic standpoint that this new copper region attracts the major interest. What are the opportunities for employment and investment there, and will this new field flood the copper market when it reaches its stride, breaking the price to such levels that the established American companies will suffer?

Union Minière, in the Belgian Congo but in the same general field, has rich properties and has been producing copper for nineteen years, beginning with less than one thousand tons in 1911. In every year but three since that time it has increased production, and its immense reserves have been considered by many to be a menace to the stability of the copper market. But in these nineteen years of generally increasing production, 1928 was the first year that the output exceeded 100,000 tons. Bwana M'Kubwa made its initial production in 1926, and in three years has achieved an annual production rate of approximately 8,000 tons. Roan Antelope will be the next: it is expected to be ready for operation by the end of 1931, and a year later it should be producing at the capacity of its initial unit, or about 50,000 tons per year. N'Kana and Mufulira, reports state, will enter the producing ranks a year or a year and a half after Roan, each with about 75,000 tons a year. All three of these properties will increase production as the market requires it; so that, ten years from now, with the other properties in that region that are on the way, the output will probably be 500,000 tons annually. A year ago, Mr. Raymond Brooks estimated the African production in 1935 at close to 340,000 tons. How much of a menace is contained in these figures?

The world consumption of copper last year was slightly in excess of 2,000,000 tons. It showed an increase of fourteen per cent over that of the year before, but this was abnormal. The increase in 1927 was only two per cent; and in 1926, three per cent, but in the two years before that it was twelve per cent. For the last nine years, since the World War, the average increase has been about nine per cent. If this nine per cent annual increase continues, the world will require in 1939, not the 2,000,000 tons it used last year, but 5,000,000 tons. Of this, Africa, according to the authorities, may be expected to produce 500,000 tons. Where is the menace?

In spite of the slowness with which Union Minière and Bwana M'Kubwa have progressed, rapid development of all these African properties may now be expected; and, in the course of ten years, one may find that deposits now unknown have become important producers. Canada's output will be greatly expanded, as will that of South America, and even the United States may hold its own or increase. But, in an electrical age, one finds it hard to believe that uses for all of this copper may not be found, and at a price that will mean a satisfactory profit to the producers. The nine per cent annual increase may be too much, but, if it is only half that, the potential menace of the great copper deposits of central Africa would seem a figment of the imagination.

Another Exception to Prove Another Rule

THE WISE MAN is naturally cautious; knowledge has given his imagination a background on which to construct hidden dangers; he knows too well the penalty of rashness. The ignorant are the ones that take unnecessary chances. Pope knew whereof he wrote when he penned the lines, "Fools rush in where angels fear to tread." Occasionally, however, the angels miss a good thing by not following.

In writing of the development of the Sunshine mine, in the Coeur d'Alene district, our Wallace correspondent recently made this interesting comment, " . . . The

control of the company had been unloaded on a group of people without experience in mining, which probably explains why a shaft was started from the lowest tunnel level [although geologically the prevailing opinion was against persistence of the ore to depth] . . . Total dividends to date are $480,000!"

Engineering and Mining Journal would not suggest that the gentlemen from Yakima, Washington, who have made the Sunshine property a consistent and a highly profitable producer, are fools. They may, for all we know, be the most profoundly erudite group of business men in the Northwest. The important point is that, inexperienced in the mining industry, they made a success out of a highly speculative mining venture that might have been a failure under competent technical direction.

The layman who considers technicians and technical knowledge of doubtful value in industry will point to an instance such as the success of the Sunshine as abundant proof of his contention. Unfortunately for his argument, however, for every instance of a successful mine developed by men inexperienced in mining a hundred could be named that are now operating only because of engineering skill. Isolated instances do not disprove the tenet which *Engineering and Mining Journal* holds—that mines are best developed by mining men.

Discovery of the Credulous as Profitable as the Discovery of Minerals

AN ADVERTISEMENT in a newspaper published at Fort Worth, Texas, adjures readers to "Drill that well when science says there is oil." The appeal comes from one who traces to the usual German chemist the invention of a "simple but scientific chemical and mechanical device, inexpensive to manufacture and easy to handle," which the promoter alleges will detect the presence of oil in the vicinity.

The claims in the advertisement and in the follow-up letter sent to prospects are carefully worded. "The instrument will be shipped to you by C. O. D. express. You deposit $25 with the express company, take out the instrument, try it out for six days, and at the end of that time, if you do not wish to keep it for any cause whatsoever, return it to the express company in good condition, and they will refund the $25, less express charges both ways . . . The instrument is small enough to carry in a coat pocket, $2\frac{1}{2}$x$3\frac{1}{2}$ in., and covered with leather, composed of chemicals and substantially constructed . . . It is almost impossible to fill my orders . . . I do not intend to sell very many."

Inasmuch as the instrument is inexpensive to manufacture and sells "like hot-cakes" at $25, the intended retirement of the promoter of this enterprise would seem a natural sequel. The curious might wonder why he did not keep the secret to himself, and profit by the discovery of even only one oil well; but the lure of successful salesmanship doubtless proved a greater attraction than mere wealth. Those who are inclined to part with $25 for such an instrument would do well to inquire why an express company has been chosen for delivery and not the United States mails.

Shovel Design Retraces Its Steps

VISITORS to the open pits of the Mesabi, in the Lake Superior iron country, find that a change in sentiment regarding shovel operation has taken place. To the casual observer the trend had previously seemed to be in the direction of bigger and still bigger shovels. Operators apparently were proud of the capacity and dimensions of the eight-yard machines, at the huge dippers of which the whole world marveled. Opinions of laymen that such was indeed the trend apparently had their confirmation last year when, after twelve-yard shovels had been introduced, a prominent manufacturer announced one having a capacity and a reach that gave good reason for further gasping. This was no less than a fifteen-yard machine, weighing 1,550 tons. Many a person sat down to calculate the size of the hole that its dipper could make at a single bite, and the length and depth of trench that one dipperful was good for. The monster's boom was 120 feet long, and material that lay at its feet could be picked up and dropped into a railroad car standing on a track 100 feet above. These large shovels, from eight-yard up, are of the full-revolving type, the entire unit, above the mounting which carries it as it rolls or crawls, swinging around in varying arc to complete each cycle. For stripping the overburden from coal or iron ore—a simple shoveling operation—these excavators are economical and give desirable low unit costs.

Nevertheless, a trend toward the use of smaller excavators is now apparent in the iron country. The advantages of the eight-yard and larger shovels in reach and in economy of operation are great, but where speed, high capacity, accuracy of loading, and ease of handling are desired, they are too large and cumbersome. For the latter objectives the smaller shovels are said to be superior. These can more readily dig different grades of ore in the same pit, without mixing any two appreciably. They are more easily handled when digging on an incline. The larger units, to use the shovel man's language, require more "plugging on the swing and crowd." They call for greater skill in spotting them over cars in loading. Trend toward the use of part-swing—instead of full-revolving—shovels is apparently also under way, the chief reason being to increase output. This harks back to the days before 1910, when the railroad-type shovel was supreme in the excavating field.

To meet these trends in one machine, a leading shovel manufacturer is now constructing a five-yard machine of the part-swing type, which will have an operating cycle that is 20 per cent faster on the average than is obtainable with the four-yard full-revolving shovel. This, in addition to the use of a five-yard dipper, will permit handling a monthly tonnage half again as large as that of the four-yard shovel and at practically the same cost.

All this means that power-shovel design has retraced its steps to fill in a gap, now apparent but previously unrecognized. By combining the part-swing feature of the railroad-type shovel with a dipper larger than was previously used on that type of excavator, and by mounting the unit on crawlers and otherwise improving it, a shovel superior to any yet produced for handling iron ore has been developed. It will by no means displace the large strippers. These undoubtedly will continue to be used for handling material that may immediately be "spoiled."

SOLVING AERIAL PROSPE

EARL HANSON

The company's slipway and the harbor at Sioux Lookout, Ont.

WHEN Northern Aërial Minerals Exploration, Ltd., was organized last year for the systematic use of airplanes in prospecting, the company launched what is probably the greatest prospecting program ever undertaken. As shown by the accompanying map of gasoline caches and flying routes, its activities, now under way and projected, cover most of northern Canada.

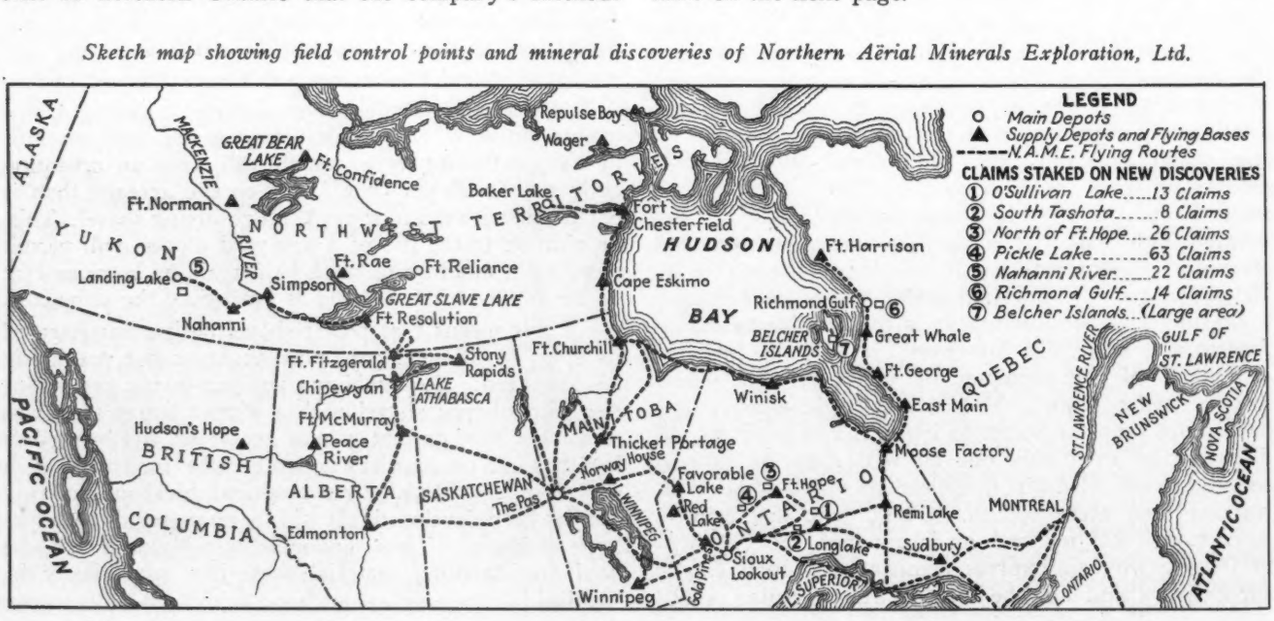
Although a great deal of prospecting was done by the company in 1928, the first season's work consisted to a large extent in "getting started"—establishing bases and gasoline caches, transporting supplies, perfecting an organization, and, above all, organizing an entirely new type of work in a systematic and effective manner. The use of airplanes for transporting prospectors and supplies was a logical step in the modernization of an important phase of the mining industry, but the step brought with it a number of problems that had not been faced before and that required extensive experimental work for solution.

Many of the problems confronted have not yet been solved. In the widespread activities of the N.A.M.E., an infinite number of local variations of climate, topography, and accessibility are encountered that must be met separately. The country around Baker Lake, for instance, is, to a large extent, bare and rocky, and a great deal of reconnaissance work can be done by a geologist in simply flying over it. The country north of Sioux Lookout, Ont., on the contrary, is to a large extent heavily timbered and requires much more ground work.

But it is in the Pickle Lake area in the Patricia district of northern Ontario that the company's methods have reached their greatest development, and the methods used there are being applied to all the activities of the N.A.M.E., with variations to meet local conditions. The main base for this region, at Sioux Lookout, is also the main base for all the operations of the company, and is by far the finest airport in northwestern Canada. A large hangar, machine shop, office, and warehouse face a sheltered bay on Abraham Lake that is ideal for mooring airplanes. The concrete floor of the hangar measures 60x70 ft., and its equipment, together with that of the machine shop, is sufficient to take care of all ordinary repairs. At the time of my visit, a Fokker Super Universal was being completely overhauled and recovered, in preparation for a trip to the Arctic. First-class housing accommodations have been provided for the staff. Six attractive and well-equipped cottages have been built for the married men, and a staff house provides quarters for fourteen single men.

At the present writing, the total flying equipment of the company, and its distribution, are as shown in the table on the next page.

Sketch map showing field control points and mineral discoveries of Northern Aërial Minerals Exploration, Ltd.



SPECTING PROBLEMS

IN NORTHERN CANADA

BY MEANS OF SYSTEMATIC UTILIZATION of the airplane for prospecting purposes, Northern Aërial Minerals Exploration, Ltd., has become a dominant factor in the determination of Canada's outlying mineral resources. As a pioneer in the application of new methods, the organization has encountered numerous problems, the solution of which has frequently required protracted periods of experimental effort. Hazard, however, owing to carefully planned methods, has been reduced to a minimum, in the company's operations.

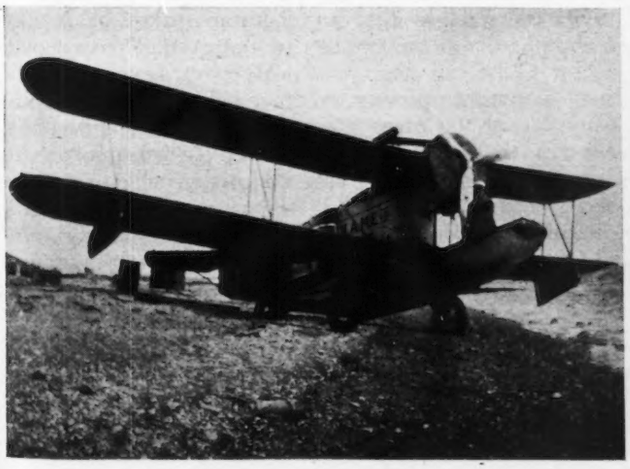
Direct charge of the field work has been assumed by Gordon Duncan, formerly assistant superintendent of the Flin Flon mine, and it is largely his efforts that are systematizing the new art of aërial exploration. Some idea of the magnitude of operations in the Pickle Lake and Patricia district alone may be gained from the fact that they are designed to cover a territory that extends about 200 miles to the north, 200 miles to the east, and 100 miles to the west—some 60,000 square miles in all. About 75 per cent of this area consists of granite, but the situation of the other 25 per cent, which consists mainly of greenstone bands, must be determined in this enormous area before it can be adequately prospected.

In operation, the flying and prospecting branches are maintained as two separate organizations. All flights have to be requisitioned by the men in charge of the field parties, and are charged up to their work. The flying for the district is done from the two sub-bases at Fort Hope and Pickle Lake, each of which contains one airplane, gasoline, oil, supplies, a pilot, a mechanic, and a mining engineer, who is assigned to the prospecting branch. Besides the supplies at these bases, six gasoline caches have been placed at strategic points in the region; these consist of ten drums of gasoline and one drum of oil each. The sub-bases are kept in constant radio communication with the main base at Sioux Lookout, utilizing the radio stations of the Ontario Forestry Service. In this way, not only the movements of the various field parties can be kept track of at headquarters, but the safety of the flyers guarded as well. For, if one flyer is not heard from for several days, that fact is an indication that he has had a forced landing somewhere and that a search airplane had better be sent after him.

Make of Airplane	Make and Rating of Motor	Headquarters of Airplane
Loening Amphibian	Wasp, 410 hp	Chesterfield Inlet
Fairchild FC2W2	Wasp, 410 hp	Chesterfield Inlet
Fairchild FC2	Wright Whirlwind, 220 hp	Norway House
D. H. Moth	Cirrus, 80 hp	Norway House
Fairchild FC2	Wright Whirlwind, 220 hp	Fort Hope
Fairchild FC2	Wright Whirlwind, 220 hp	Pickle Lake
Avro Avian	Cirrus, 80 hp	Sioux Lookout
Fairchild FC2	Wright Whirlwind, 220 hp	Sioux Lookout
Fokker Super Universal	Wasp, 410 hp	Sioux Lookout

The men at work in the area, not including the flying staff of pilots and mechanics, consist of 36 prospectors. These work in parties of two each, and nine such parties are under the direction of one mining engineer. In addition, three working parties of from two to seven men each, which are headed by a third engineer, are in the field. At present, prospecting is carried on only in summer, and most of the men are laid off during the

A Loening Amphibian at Baker Lake, in the sub-arctic



An Avro Avian—type of airplane used for reconnaissance.

winter. In the winter, all necessary overhaul work is done on the airplanes. Moreover, the machines are kept busy, freighting supplies to the finds of the season before, establishing caches for the following summer's work, and making reconnaissance flights.

Last summer's work indicated a number of areas in the district where it was advisable to begin work this year, and the men were flown to their respective locations before the break-up of the ice on the lakes, while the planes were still equipped with skis. There was no possibility whatever of reaching the parties until after the disappearance of the ice—both dog teams and canoes are useless during the break-up period, and, because there are absolutely no landing fields anywhere in the region, the airplanes are equally dependent on the condition of the lakes. Each party of prospectors was furnished with the supplies listed in the accompanying table. In addition, each prospector was given written instructions as to "what to look for" and "things to remember."

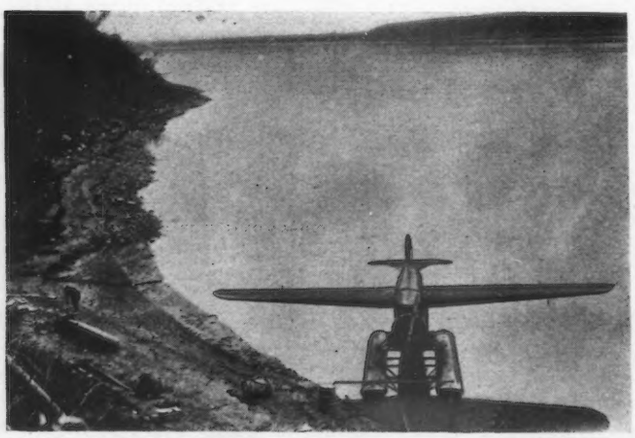
The former include the usual signs of mineralization, quartz veins, and iron oxidation, with detailed instructions as to how to examine them in detail. The latter are concerned, in general, with good practice in prospecting, and specifically, with the prospectors' relations to airplane service.

Special Signaling Protects the Service

Each party is given an orange flag which is to be flown at the camp whenever an airplane is expected or wanted for some special reason. On the day scheduled for the plane's arrival, as well as on any day when the signal flag is flown, at least one man is to remain in camp. He is to keep a fire burning continually, with a pile of green boughs near by, and, as soon as an airplane comes into sight, he throws the boughs on the fire for a smoke signal. If a prospector is lost, he is to find some large lake, suitable for landing airplanes, and stay there, signaling for an airplane with the flag, if he has it, or with the smoke signal alone, if he hasn't.

Although instructions to be followed if they become lost are given to the men, no need for them has yet occurred. Up to the time of the present writing not one of the men, many of whom have been working in absolutely unknown territory, has been lost. When all his parties are in the field, the engineer generally has some time on his hands before his next visits to the prospectors. This period is used for reconnaissance work.

The geological map of the region published in 1910 is utterly inadequate and indicates only geological formations along the main water-courses. Between these features on the map are large blank spaces. Guided by hints and indications from the map, the engineer makes flights over the unknown territory to observe the general nature of the ground and to pick favorable locations for the work of the prospectors. Where the ground is not too heavily timbered, a great deal of geological work can be done from the air by a trained observer, the object being at all times to pick out dikes and greenstone formations. Visits to prospecting parties are scheduled about a month apart, but the schedule is made elastic enough to allow for delays resulting from unfavorable weather. If party *A*, for instance, is scheduled for a visit on the first of the month, party *B* will not be on the schedule until three or four days later, thus preventing a tie-up of the entire routine in the event of a few days' bad flying weather.



Establishing a temporary gasoline cache at Landing Lake, North West Territory

Main base camp at Sioux Lookout, Ont., from the air. The married men's quarters are at the right.

At the time of the engineer's visit to the prospectors, the latter are to have written reports ready, covering the region in which they have worked. These reports also give him a fair idea as to the thoroughness with which they have worked. The engineer must then decide whether they are to be moved to a new location or whether their area merits further investigation. In the latter circumstance, notes are made as to their need for supplies, which are flown in to them at the earliest opportunity. The engineer makes out a report, which he forwards to the field headquarters office at Sioux Lookout, together with the prospectors' reports. Information thus furnished is here used to complete the geological map, on which the positions of the various prospecting parties are also marked at all times.

Geological Maps Made on Every Flight

On every flight that an engineer makes he is also required to map the geology of the ground passed over as far as he can observe it. Moreover, every time he visits a mining property, whether belonging to the company or not, he turns in a report of his observations. All data thus obtained are used at field headquarters to complete the general working map, from which the positions of prospectors can in the future be determined. The prospectors are carefully picked by reputation, and are generally hired in pairs that are used to working together. They are given systematic instructions in practical geology. Each engineer has two cases containing samples of Canada's principal minerals. He keeps one case always with him, to illustrate his talks with the men; the other case is left with various parties in rotation, giving them a chance to examine the samples at their leisure.

The hangars at Sioux Lookout. All necessary repairs to airplanes are made here in well-equipped shops.

When a strike is made, one of the working parties is immediately flown to the scene to do trenching and to make a closer examination, and, if this work discloses favorable indications, staking and recording begins. All available men with miners' licenses are then flown to the scene, each to stake out his maximum number of claims. Under a written agreement, which gives Northern Aërial Minerals Exploration power of attorney, these claims revert to the company; the interest of the prospectors, however, is held through an agreement that gives them 10 per cent of the revenue from their claims, in addition to their monthly wages.

When a strike is made, at least one of the working parties is kept there to do assessment work and to make further investigations. If these give favorable results, the company, which is a prospecting company and not a mining concern, has two alternatives: It can either sell its holdings to another concern or form a subsidiary to buy any one property from the holding company. The test case for this eventuality, however, has not yet arisen.

Development and assessment work is being pushed on two of the seven strikes made last season, the others being held for the future. The 63 claims staked at Pickle Lake show the highest promise. Surface trenching has furnished samples containing as much as $125 in gold over a width of 5½ ft., and preparations are being made this year for diamond drilling this property.

Only Most Promising Discoveries Are Staked

The objection has been raised that the use of airplanes gives too easy a means of transportation—makes it easy to find properties that are too far removed from the kind of transportation needed for development and production. To a certain extent this is true. Flying prospectors into the wilderness is an easy matter compared to taking the ore out profitably. But in answer to this point, we have only to look at present trends in Canada and to note that field men are instructed to stake nothing that is not exceptionally good.

The Canadian railroads are today undergoing a period of active expansion northward, wherever there is a prospect of real development and traffic. The North is being tapped at all favorable points. At the time of its discovery, Flin Flon was utterly inaccessible for production purposes; completion of the new railroad from The Pas materially altered the situation. Sherritt-Gordon was in a similar predicament. A charter has been issued to the Canadian Pacific Railway to build a line into the new Rotten Stone Lake district, which today is accessible only by such means as airplanes, canoes, and tractors. The Hudson Bay Railroad has reached Churchill, and the T. & N. O. is being pushed toward James Bay. The two railroads last named make prospecting along the shores of Hudson Bay almost inevitable. Northern Aërial Minerals Exploration has holdings far up the east coast of the bay. Three mining companies are today investigating the region at Chesterfield Inlet and Baker Lake, where a few years ago the only feasible commercial venture was trading with the Eskimos. N.A.M.E. has taken control of the entire Belcher Islands' iron deposits, said to be the largest in the world and which are again looming in importance, owing to the present developments along Hudson Bay. In a few years Hudson Bay will be an important body of water for commercial navigation, and mines along its shores will have transportation facilities equal to those of the Spitsbergen coal mines.

A great deal of money has been invested in this prospecting venture of Northern Aërial Minerals Exploration, but no more than can be recovered with one real find. Another Flin Flon or another Sherritt-Gordon, within the next few seasons, should pay back the entire capital cost of the venture. And, with quick transportation over the entire Pre-Cambrian shield, combined with some of the best geological minds in Canada, the eventual discovery of such a mine should not be far off.

Prospecting Outfit for Two Men[a]

1 canoe, built in three sections for transport by air.	1 gold pan.
3 paddles.	1 carborundum stone.
1 silk tent, fly proof.	3 forks.
1 ground sheet, 7x9 ft.	1 troll line.
5 pack sacks.	1 lead sinker.
2 haversacks.	2 spoon trolls.
30 sample bags, 12x14 in.	10 assorted fishhooks.
3 dunnage bags.	2 dish towels.
5 concentrate bags, 14x20 in.	1 first aid kit.
1 tump line	1 stick "Stop a Leak."
100 ft. sash cord.	1 package of copper canoe tacks.
1 ball twine.	5 yd. cheesecloth.
1 coil light wire.	6 lead pencils.
2 axes.	50 tags.
2 prospecting picks.	1 trench shovel.
1 verona pick.	4 packs of note books.
8 moils.	2 writing pads.
4 pails (nested)	1 small mortar.
4 cups.	1 reflecting oven and pan.
5 plates.	18 copper rivets.
2 frying pans.	100 metal rimmed tags.
2 small g. p. pans.	1 steel mirror.
2 watertight match boxes.	1 yd. of canvas for mending canoe.
1 can opener.	1 tin of glue for mending canoe.
1 file.	3 table knives.
2 2-oz. bottles for fly oil.	1 butcher knife.
1 small tin can for main supply of fly oil.	3 large spoons.
	3 small spoons.
	1 salt shaker.

(a) Twice this equipment, with the exception of the frying pans, is provided or a party of four men. The men provide their own sleeping bags and blankets

Use of Flotation in Mexico Doubled in Two Years

ACCORDING to the mining section of the Department of Commerce, Industry and Labor, of Mexico, flotation has been making rapid strides in metallurgical plants of mining companies operating in that country. In 1926, a total of 2,112,506 tons of ore was treated by flotation in Mexico. In 1927 this figure had increased to 3,573,804 tons and in 1928 to 4,073,413 tons. For 1928, the total treated by flotation methods was 32.30 per cent of all ore mined in the republic. At present, 33 flotation plants are in operation in Mexico, including two new plants now being constructed. A further increase in the tonnage treated by flotation is expected this year.

Corporate Relations of Northern Rhodesian Mining Companies

A. B. PARSONS

Vice-President, Mineral Research Corporation, New York

THE purpose of the accompanying chart and tables is to show in a general way the participation of about 25 holding and operating companies interested in the ownership and control of the remarkable copper deposits of Northern Rhodesia; and to indicate the ore reserves so far developed and partly developed, and potential production rates.

In considering the possibilities of the Rhodesian copper mines, several factors must be given attention, such as labor, power and fuel, transportation, the time element, capital requirements, market for the product, ore reserves and estimates, and costs of production.

The labor problem will be a serious one and may

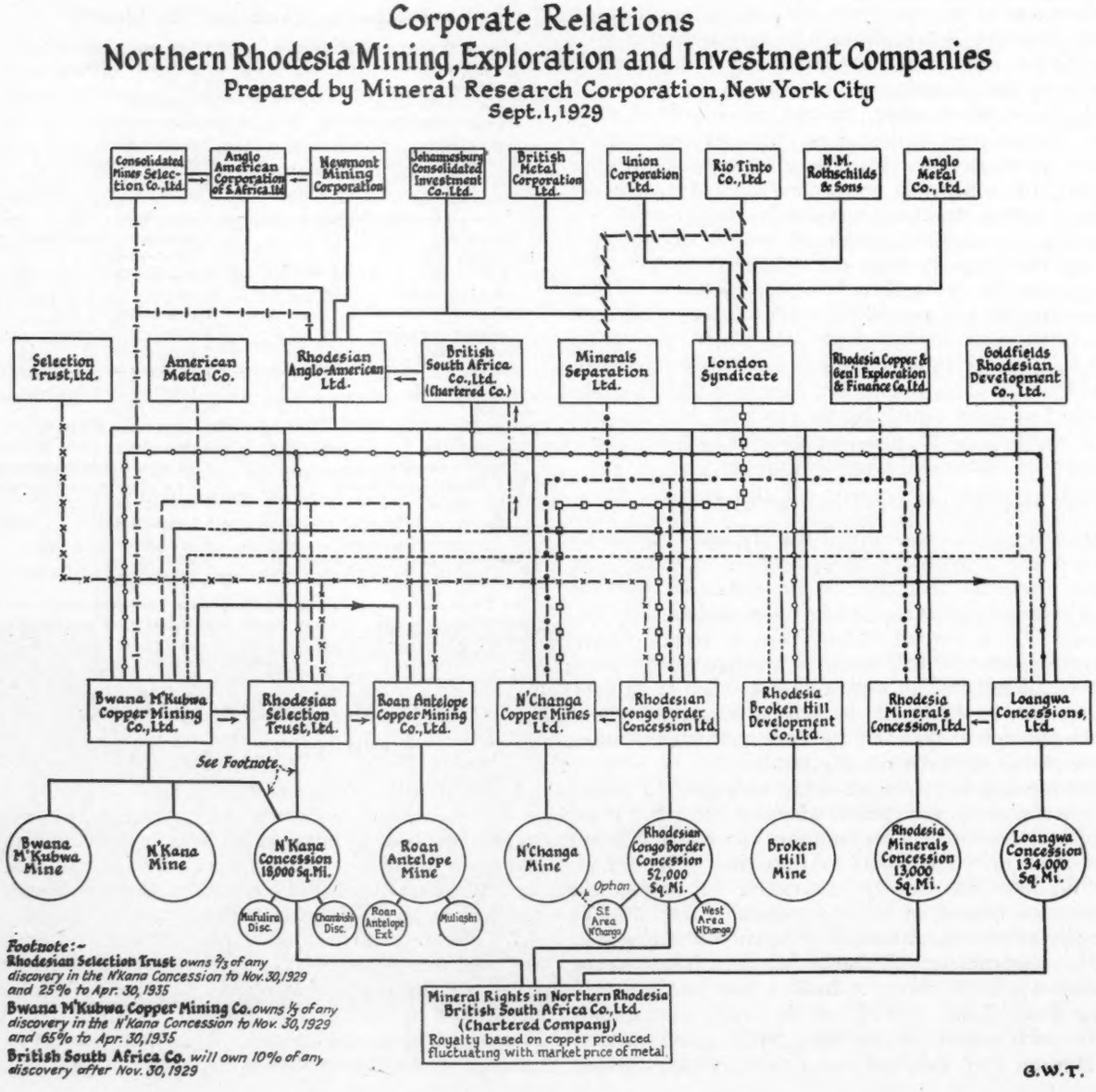

Corporate Relations
Northern Rhodesia Mining, Exploration and Investment Companies
Prepared by Mineral Research Corporation, New York City
Sept. 1, 1929
Consolidated Miner Selection Co., Ltd.
Anglo American Corporation of S. Africa Ltd
Newmont Mining Corporation
Johannesburg Consolidated Investment Co., Ltd.
British Metal Corporation Ltd.
Union Corporation Ltd.
Rio Tinto Co., Ltd.
N.M. Rothschilds & Sons
Anglo Metal Co., Ltd.
Selection Trust, Ltd.
American Metal Co.
Rhodesian Anglo-American Ltd.
British South Africa Co., Ltd. (Chartered Co.)
Minerals Separation Ltd.
London Syndicate
Rhodesia Copper & Gen'l Exploration & Finance Co, Ltd.
Goldfields Rhodesian Development Co., Ltd.
Bwana M'Kubwa Copper Mining Co., Ltd.
Rhodesian Selection Trust, Ltd.
Roan Antelope Copper Mining Co., Ltd.
N'Changa Copper Mines Ltd.
Rhodesian Congo Border Concession Ltd.
Rhodesia Broken Hill Development Co., Ltd.
Rhodesia Minerals Concession, Ltd.
Loangwa Concessions, Ltd.
See Footnote
Bwana M'Kubwa Mine
N'Kana Mine
N'Kana Concession 18,000 Sq. Mi.
Roan Antelope Mine
N'Changa Mine
Rhodesian Congo Border Concession 52,000 Sq. Mi.
Broken Hill Mine
Rhodesia Minerals Concession 13,000 Sq. Mi.
Loangwa Concession 134,000 Sq. Mi.
Option
Mufulira Disc.
Chambishi Disc.
Roan Antelope Ext
Muliashi
S.E. Area N'Changa
West Area N'Changa
Footnote:-
Rhodesian Selection Trust owns 2/3 of any discovery in the N'Kana Concession to Nov. 30, 1929 and 25% to Apr. 30, 1935
Bwana M'Kubwa Copper Mining Co. owns 1/2 of any discovery in the N'Kana Concession to Nov. 30, 1929 and 65% to Apr. 30, 1935
British South Africa Co. will own 10% of any discovery after Nov. 30, 1929
Mineral Rights in Northern Rhodesia British South Africa Co., Ltd. (Chartered Company)
Royalty based on copper produced fluctuating with market price of metal.
G.W.T.

Table I—Northern Rhodesian Holding, Investment, Exploration, and Mining Companies

Name	Capitalization, Shares: Authorized	Par Value	Outstanding	Rhodesian Share Holdings: Company	Number(f)
American Metal Company, Ltd.	100,000	$100(b)	68,541	Roan Antelope	540,000
	2,000,000	No par	854,868	Rhodesian Selection Trust	280,000
				Bwana M'Kubwa	1,250,000
Anglo American Corporation of South Africa, Ltd.	5,000,000	10s(b)	4,000,000	Rhodesian Anglo American	Presumably control
	5,000,000	10s	4,000,000		
British South Africa Company, Ltd.	9,000,000	15s	8,760,502	Bwana M'Kubwa	.....
				Loangwa Concessions	334,777
				Rhodesian Congo Border	20,000
				Rhodesia Minerals Concession	139,916
				Rhodesia Broken Hill Development	.....
				Rhodesian Selection Trust	.....
Consolidated Mines Selection Company, Ltd.	1,200,000	10s	All	Anglo American Corporation	524,425
				Bwana M'Kubwa	.....
				Rhodesian Anglo American	.....
London Syndicate				Rhodesian Congo Border	299,871
British Metal				N'Changa	200,000
Johannesburg Consolidated Investment					
Rio Tinto	No Public Participation				
Union Corporation					
Anglo Metal					
Rothschilds					
Minerals Separation, Ltd.	500,000	£1	200,000	Rhodesian Congo Border	76,600
				Rhodesian Minerals Concession	6,000
				N'Changa	70,300
				Bwana M'Kubwa	.....
Newmont Mining Company	800,000	$10	503,224	Anglo American Corporation of South Africa	.....
				Rhodesian Anglo American	.....
Rhodesian Anglo American, Ltd.	5,000,000	10s	5,000,000	Bwana M'Kubwa	1,871 000
				Bwana M'Kubwa (under option)	1,098,738
				Loangwa Concessions	.....
				N'Changa Copper Mines	.....
				Roan Antelope	.....
				Rhodesia Broken Hill Development	.....
				Rhodesian Congo Border	.....
				Rhodesian Selection Trust	.....
				Rhodesia Minerals Concession, Ltd.	.....
Rhodesia Copper & General Exploration & Finance Company, Ltd.	1,610,368	3s	1,173,405	British South Africa Company, Ltd.	.....
				Rhodesia Broken Hill Development	.....
				Bwana M'Kubwa (Debentures)	.....
Selection Trust, Ltd.	200,000	£1(c)	200,000	Rhodesian Congo Border	.....
	600,000	£1	600,000	Rhodesian Selection Trust	1,200,000
	400,000	£1(d)	300,000	Roan Antelope	630,000
Bwana M'Kubwa Copper Mining Company, Ltd.	14,000,000	5s	8,842,660	Rhodesian Selection Trust	80,000
Company owns N'Kana mine and interest in N'Kana concession with Mufulira and Chambishi discoveries.(a).	1,000,000	£1(d)	859,375	Roan Antelope	62,500
Goldfields Rhodesian Development Company, Ltd.	3,485,780	10s	2,514,220	Bwana M'Kubwa	.....
				Loangwa Concessions	172,575
Loangwa Concessions, Ltd.	6,400,000	5s	4,402,867	Rhodesia Minerals Concession	24,000
N'Changa Copper Mines, Ltd.	1,000,000	£1	900,000	.....	.....
Rhodesia Broken Hill Development Company, Ltd.	10,000,000	5s	9,045,300	Loangwa Concessions, Ltd.	147,648
Rhodesian Congo Border Concession, Ltd.	700,000	£1	700,000	N'Changa	394,666
	50,000	£1(e)	49,678	N'Changa (under option)	100,000
Rhodesia Minerals Concession, Ltd.	800,000	5s	388,706	Luiri Gold Areas, Ltd.	.....
Rhodesian Selection Trust, Ltd.	4,000,000	5s	3,524,325	Roan Antelope	237,500
Company owns N'Kana concession and also has interest in Mufulira and Chambishi discoveries(a).					
Roan Antelope Copper Mines, Ltd.	5,000,000	5s	4,844,133	.....	.....
Company owns Roan Antelope Extension and Muliashi.					

(a) Rhodesian Selection Trust owns two-thirds of any discovery in the N'Kana concession to Nov. 30, 1929, and 25 per cent to April 30, 1935. Bwana M'Kubwa Copper Mining Company owns on -third of any discovery in the N'Kana concession to Nov. 30, 1929, and 65 per cent to April 30, 1935. British South Africa Company will own 10 per cent of any discovery after Nov. 30, 1929

(b) 6 per cent preferred. (c) 7½ per cent preferred. (d) Debentures. (e) "A." (f) Data from published reports, but not all official. Important changes may have been made since date of reports.

retard the speed with which the properties are opened up and equipped, limit the scale of operations, and increase the cost of production. For power, steam will be dominant at first, though, later, hydro-electric energy may be developed. The cost should be about £24 per kilowatt-year. Transportation will be costly, though, with the added rail facilities, probably adequate. Profitable operations are unlikely at any of the properties

Table II—Data on Ore Reserves, Production, and Operating Costs at Principal Rhodesian Copper Properties

Property	Ore Resources: Official Estimate Tonnage	Grade	Conjecture Based on Semi-Official Data Tonnage	Grade	Production From Initial Unit: Ore per Day, Tons	Copper per Year, Pounds	(a) Cost Including Taxes and Depreciation (Cents per Pound)	Earnings per Year 14c. Copper	17c. Copper	Possible Annual Production in 1939 (Pounds of Copper)
Bwana M'Kubwa	3,000,000	3.8	7,000,000	3.8	1,000	15,000,000	16.0—16.5(b)	$300,000(c)	$75,000	15,000,000
Roan Antelope (including Roan Antelope Extension and Muliashi)	50,000,000	3.4	250,000,000	3.4	5,000	100,000,000	9.5—10.0	4,500,000	7,000,000	250,000,000
N'Kana	36,000,000	4.3	100,000,000	4.2	5,000	125,000,000	9.0— 9.5	6,250,000	9,375,000	250,000,000
Mufulira	45,000,000	5.0	100,000,000	5.0	5,000	150,000,000	9.0— 9.5	7,500,000	11,250,000	250,000,000
N'Changa	35,000,000	3.8	75,000,000	3.5	5,000	100,000,000	11.0—11.5	3,000,000	5,500,000	150,000,000
Chambishi (and or other area in N'Kana Concession)	12,000,000	3.0	50,000,000	3.0	3,000	50,000,000	10.0—10.5	2,000,000	3,250,000	50,000,000
N'Changa West Extension (and or other area in R. C. B. Concession)	.....	...	50,000,000	6.0	3,000	100,000,000	10.5—10.5	4,000,000	6,500,000	100,000,000
Totals	181,000,000		632,000,000							1,065,000,000

(a) The first figure is an estimate based on 14c. copper; the second on 17c. copper. (b) These costs apply only to the old Bwana M'Kubwa mine. (c) Deficit.

inside of five years, and all except Roan Antelope will need further financing, at a cost of approximately twenty million dollars for a 5,000-ton mining and metallurgical plant. No difficulties are expected in marketing the copper at a price between 14 and 17c. Ore reserves are great and can be estimated with reasonable accuracy; for most of the properties the grade of the ore is more important at present than the ultimate tonnage. Costs of production, including taxes and depreciation, seem likely to vary between 9 and 11c.

The ore deposits of present chief interest are:

Bwana M'Kubwa, the only producer in Northern Rhodesia today whose ore offers a metallurgical problem that has prevented profitable operation so far.

Roan Antelope, in which the American Metal Company is interested, and which is expected to be the second mine to reach the production stage.

N'Kana, which the Bwana M'Kubwa company owns, higher in grade than Roan Antelope, and likely to be next after it in reaching production.

Mufulira, which may reach production about the same time as N'Kana; an enormous tonnage of comparatively high-grade ore likely.

N'Changa, a body of oxide ore that may offer metallurgical difficulties.

Chambishi, resembling Mufulira, though of lower grade and of more conjectural possibilities.

N'Changa West Extension, largely undeveloped but of interesting possibilities judged by 6 per cent ore found in widely spaced drillholes.*

Russian Platinum Industry Reorganizing

CONSIDERABLE reorganization has taken place during the last year in the Russian platinum industry, according to G. F. Kunz, who writes on the subject in the current issue of *The Mineral Industry,* which was published this fall by the McGraw-Hill Book Company. On Oct. 1, 1928, the Uralplatina, the state trust in charge of the industry, was discontinued as a separate organization and was consolidated with the Soyuz-Zoloto, the state trust in charge of gold mining, to consolidate the handling of all of the precious metals under a single head. The Uralplatina was organized in 1921, uniting the production of the six important platinum-bearing districts of the Urals, and the two refineries at Sverdlovsk and Moscow. The trust had the exclusive right to buy platinum from private persons throughout Russia, and to refine and manufacture the metal.

To encourage and promote the industry under the Soyuz-Zoloto, platinum producers have been freed from state and local taxes, collections and duties, except taxes for local government, which shall not exceed 2 per cent of the cost of production of the platinum group metals actually mined. No postage or express charges are to be paid by those shipping platinum metals to the treasury departments of the various states or of the Union, or to the Soyuz-Zoloto, such charges being paid by the office to which the metal is consigned. The wages of all persons engaged in the industry are exempt from all taxes in excess of 2 per cent of their total earnings, except for social insurance taxes. Timber and lumber for the platinum industry are to be sold at a discount of 50 to 75 per cent by the state forests and lumber yards.

In addition to the transfer of the direction of the industry from the Uralplatina to the Soyuz-Zoloto, the headquarters of the trust have been moved to Irkutsk, Siberia, in accordance with the general plan to grant autonomy to the outlying provinces in the management of their local industries. Among the steps being taken for the improvement of the technical side of the industry are special training courses in Leningrad and Moscow for engineers, technicians, and other personnel in the industry.

*An abstract of a paper entitled "Rhodesian Copper Mines," copies of which are available without cost to *E.&M.J.* readers by addressing Mineral Research Corporation, 120 Broadway, New York City.

Columbium Now a Commercial Metal

AT THE recent exposition in New York, the first metallic columbium made in the United States was exhibited by Dr. C. W. Balke, chemical director of Fansteel Products Company, North Chicago, Ill. Columbium, *Iron Age* recalls, is a rare metal similar in many ways to tantalum, which also was first produced in America by Dr. Balke.

Like tantalum, columbium is inert to practically all chemical action, and is soluble only in a mixture of nitric and hydrofluoric acids. In electrolytes the metal is uni-directional. It readily absorbs gases by occlusion, and has been patented as a "getter" in vacuum tubes. Columbium is very ductile and is easily worked cold. It may be rolled, drawn, hammered, formed, or cut with ordinary working tools. It welds readily to itself and other metals by the spot-welding process. However, the metal must not be subjected to any great amount of heat in the atmosphere, or it will become brittle.

Except for about one-half ounce made by Siemens in 1906, the Fansteel exhibit represented, it is asserted, all the metallic columbium in the world. The exhibit consisted of several pounds of the metal in sheets, bars, rods, and wire.

Workable deposits of columbite occur in the Black Hills of South Dakota. The ore is also found in several other places on the North American continent. In value, the metal is about one-seventh the price of platinum and one-half the price of gold.

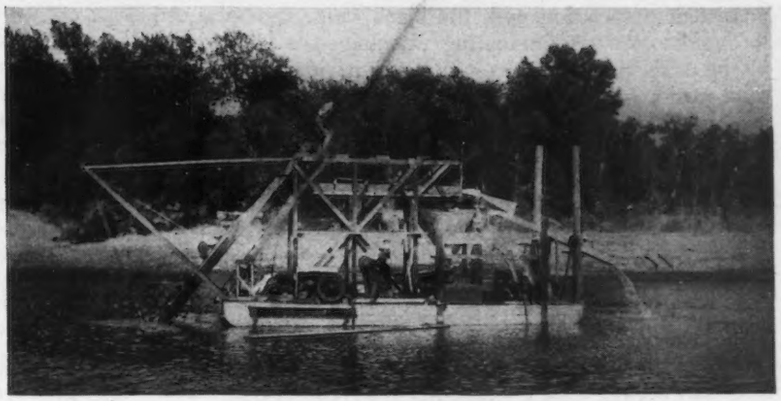
New Uses for Lead Developed

IN addition to amaloy, which is being used for soldering work in the automobile industry and in the manufacture and installation of electrical equipment, a few other new uses for lead have come into prominence lately, and some of these may develop into important items of consumption, says Lewis A. Smith in a report recently issued by the U. S. Bureau of Mines. In building construction, interest is evoked by the use of lead mattresses to act as shock absorbers between the foundations and the steel framework of skyscrapers. In one building in New York about 55 tons of lead appears to have been used for this purpose.

In the pigment field a new lead preparation called "subox" has been introduced. This preparation, which consists of very finely divided particles of lead suboxide suspended in linseed oil, can be sprayed or applied with a brush upon any surface. After being applied it undergoes a slow transformation, resulting in a film of metallic lead held firmly as a protective coat by the oxidized oil.

Recovery of Flour Gold *from* River Sand

Edwin A. Sperry
Department of Metallurgy, Pei-Yang University, Tientsin, China



Close view of the dredge

In 1909 I was employed to make a thorough investigation of the economic value of the sand which had accumulated in the Feather River from the hydraulic operations on the Yuba and Bear rivers, in California. Government reports gave the impression that the black sand carried the gold in combined form. This assumption was proved incorrect; it existed as individual microscopic particles, separate and uncombined. Many assays made in the field showed the sand to have a general assay value ranging from 10 to 20c. per ton, which results were verified by check assays made in regular laboratories. Sampling was performed over a distance of about 20 miles from Marysville to the south. The bars were laid out in 100- to 200-ft. squares, and samples were taken at each intersection for depths of from 5 to 15 ft. In all, over 200 samples were taken, showing a consistent content for the entire distance.

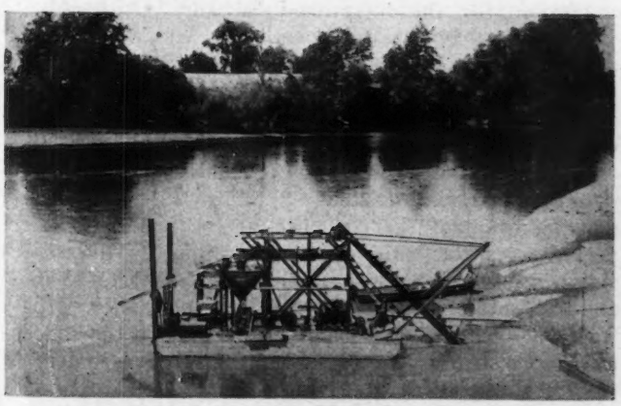
A careful physical analysis of the sand indicated that it consisted of from 80 to 90 per cent gray, light siliceous sand, 10 to 20 per cent red sand, somewhat heavier than the gray, and an almost constant proportion of 0.5 per cent black sand. Sizing tests demonstrated that from 15 to 25 per cent passed 60 mesh, depending on the general character of the bar from which it came. All the black sand was finer than 60 mesh, and a large proportion passed 100 mesh.

The red sand was somewhat coarser, and the gray sand ranged from 100 to as coarse as 10 mesh in some instances.

Panning, if carried to a point where a small amount of the red sand remained, resulted in a complete recovery of the gold; but if carried further, to complete cleaning of the black sand, the recovery dropped to a low point. In the first instance a concentrate of from $20 to $30 could be obtained; in the second, the yield would often drop to less than $1. The conclusions which can be drawn from these facts are obvious.

Owing to the minute condition of the gold and low grade of the sand, either direct amalgamation or cyanidation was not suited for the purpose. Concentration had to be depended upon. Even with this method, if it could be used, the strictest economy must be observed. To prove the adaptability of concentration, a lot made up from the 200 samples taken for individual assay, amounting to 250 lb., assaying 11c. per ton, was run over a Card concentrator. The results showed that a concentration of 185 to 1 gave a product carrying $18.80 per ton, with a recovery of 89.5 per cent of the total. This clearly proved the possibilities of the method. Even with the high efficiency as regards recovery, the low capacity of concentrators of this type, which could hardly be estimated as more than 30 tons in 24 hours for each machine, brought the economy of the method far below what it should be. When the quantity to be handled each day—

The dredge in operation



A portion of the old channel

from 2,000 to 3,000 tons—is taken into consideration, the number of tables necessary would be excessive. The cost of installation and operation and upkeep would be high.

In studying the problem and taking the physical conditions into consideration—the fineness of the gold, its persistent association with the black sand, and the need to avoid excessive eliminating washing—the idea of applying screening methods presented itself. Tests were then made, which showed that about 10 per cent of the sand, in that special sample, would pass an 80-mesh sieve and that almost all the black sand, with the gold, was included in this. Assays of the original sand and the undersize product indicated 10c. per ton gold in the former and $1 in the latter—an almost complete separation of the gold in one-tenth of the original volume. This screening was done under a strong jet of water.

The result indicated a promising line of investigation, and much time was given to devising a screen that would combine capacity and economy. Several types were tried, but none seemed to meet all the conditions and requirements until a Ferraris screen was used. This, having a forward and upward tossing motion, progressed the sand quickly, about 6 ft. in 10 sec., and made a satisfactory product.

The first screen used was 6 ft. long, 25 in. wide and had 60-mesh screen cloth for the entire length. Three spray pipes were placed at equal intervals over this. This screen developed a capacity of 100 tons per 24 hours for each 1 ft. in width. To cut down the amount of siliceous sand that passed through the screen, those portions lying between the points acted upon by the sprays were covered with sheet iron, leaving only 8-in. sections of the screen directly underneath the sprays. The results of this arrangement were at once apparent and surprising. Instead of passing from 15 to 25 per cent of the original sand finer than 60 mesh, only 2 to 3 per cent passed, and this product still contained almost all of the black sand and gold.

As the sand progressed over the plain surfaces, the tossing motion gave a perfect stratifying action, causing the black sand, with the gold, to settle to the surface of the plate. As it passed over the narrow screen section, this black sand was the first material to be affected by the momentary action of the strong curtain spray, thereby giving a decidedly selective screening action. This gave an initial concentration ratio of about 40 to 1, with a product carrying about 20 per cent black sand and 80 per cent of red and gray sand.

Then the product was settled in a dewatering cone to about 25 to 30 per cent solids. In constructing this dewatering cone the peripheral overflow trough was designed to form a sand filter, by having a false bottom of screen cloth on which was placed a bed of black sand, in case any of the fine gold should remain suspended in the overflow water. Several tests, however, showed that this condition rarely occurred, if ever. The cone product was treated on a concentrator, by which a further concentration, 4 to 1, was obtained, or a total of 160 to 180 to 1. The question of final treatment was then investigated.

Final extraction of the gold from the black sand was necessarily confined to one of the three ordinary methods —(1) amalgamation; (2) cyanidation, and (3) chlorination. The third, chlorination, was outside consideration in this case, owing principally to the fact that the black sand, magnetite, would be acted on by the chlorine, thereby causing an excessive loss of the solvent. As to cyanidation, fully 90 per cent of the gold could be extracted thus, but the time of treatment, about 96 hours, was too long for economy. Other factors also militated against its adoption.

Special attention was then directed toward the devising of means whereby amalgamation might be applied. This finally resulted in the adoption of a revolving barrel with longitudinal, peripheral shelves, by which the black sand would be constantly mixed with mercury. The charge was wet enough to form a fairly thick mud, say 60 per cent solids, through which the mercury was disseminated in a finely divided condition. The mixing was carried on for four hours. In the first test, water alone was used, but the results were poor. On adding a small amount of potassium cyanide to clean the gold, the assays on the tailing sand thus treated showed merely a trace of gold, from an original sand of $4.50. As such an operation can be made continuous, the costs can be reduced to a small figure as to installation, operation, and maintenance.

To make a practical working test an experimental dredge was constructed in 1925 with a capacity of 250 tons per 24 hours. This was operated for the double purpose of proving the actual efficiency of the method, and to determine as nearly as possible the cost of its operation. Results in operating even this small plant indicated an efficiency of recovery equal to the results indicated by the laboratory work, and an actual cost of operation less than 3c. per yard of sand handled. Even this figure could probably be cut down in the operation of a large plant.

At the time of the construction of the experimental plant, sixteen years after the original sampling of the bars, special attention was given to the development of the method. Experimental work with several types of screen and the final development of the sectional screen was completed at about the end of the season of 1926. In the following year special attention was directed to the location of bars having sufficient gold to warrant operation. During the interval 1909-25, the level of the river had fallen from 10 to 15 ft., so that most of the old bars had been cut out and partly replaced by a later deposit, which carried much less gold—from 3 to 5c. per ton.

At one point, where the river had been deflected, some of the old bars were found to have retained the gold shown in the original sampling of 1909. These were flanked by large bars of the later deposit, which made it impracticable to reach them with the small equipment. This precluded the possibility of actual operation with the experimental dredge. Although the proportion of black sand in the later bars was the same as that of the older bars—about 180 to 1—the gold had evidently been washed out and distributed over a much larger and comparatively barren area in the lower reaches of the river.

Although these conditions precluded the possibility of economic operation, they still allowed of a conclusive demonstration of the efficiency of the method. In repeated tests the ratio of concentration by the screen action was consistently uniform, at from 35 to 45 to 1, and the tailing from the screen invariably showed only traces of black sand and gold. The gold in the concentrate, consistently proportional to the original content of the sand, ranged from $4 to $8.

Copper Queen Concentrating Operations

CHARLES W. TULLY

WITH the prospective development of the low-grade porphyry orebodies of the Phelps Dodge Corporation came the need for a concentrator to treat this ore successfully before shipment to the smelter. Development of modern methods of concentrating these ores was accordingly started by the company in 1918. In anticipation of the treatment by concentration of the Sacramento Hill west orebody, a pilot plant was constructed and operated between 1918 and 1920, the design of which called for treatment by both gravity and flotation processes, flotation constituting an intermediate process between roughing and finishing tables. This method was adopted because of the characteristics of the ore, which made fine grinding unnecessary for the purpose of separating mineral from gangue; also because of the need for a large proportion of coarse concentrates for subsequent smelting operations and of pyrite for flux in smelting the siliceous copper ores. Based on the results of this pilot plant, the construction of a concentrator of 4,000 tons' daily capacity was decided upon, with a flow sheet practically the same as that of the pilot plant.

With the construction of the concentrator completed, operations started in April, 1923. With the exception of the crushing plant, the design of which has not been changed since the start of operations, a great many improvements have been made, which have resulted in a simple yet far more efficient flow sheet than was primarily in effect. This originally called for three-stage coarse crushing to 1½ in. maximum size, two-stage grinding, and tabling with intermediate flotation. The ore was delivered in railroad cars to an 86x66-in. Allis-Chalmers jaw crusher, which discharged a 10-in. product to a 1,000-ton surge bin. Two No. 9 Gates gyratory crushers constituted the secondary crushing stage, producing 4-in. material, which went directly to four 48-in. Symons horizontal disk crushers. The discharge of these crushers, 1¼- to 1½-in. maximum, dropped onto a conveyor, which carried it to the fine-ore bins preparatory to grinding.

In addition to crushing the milling ore, the plant was designed to handle the direct smelting ore from the smaller high-grade deposits known to exist in the larger orebody. Additional bins of 8,000 tons' capacity, in which the crushed smelter ore could be stored prior to shipment to the smelter, were constructed, and a two-way conveyor was installed under the disk crushers, so that their product could be thrown to either bin as the case might be. The crushing plant was designed for an hourly capacity of 500 tons—sufficiently greater than the mill capacity to take care of any contemplated increase in tonnage as well as the time required for necessary repairs.

To continue with the flow sheet: The 1½-in. material from the fine-ore bins was fed to eight 6x12-ft. single-pass Marcy rod mills, which reduced it to 14 mesh, this product then being treated on 40 roughing tables, which produced a concentrate assaying from 4 to 5 per cent copper, 25 to 30 per cent insoluble, and about 30 per cent iron. This constituted approximately 50 per cent of the total concentrate. The table tailings, after being deslimed, were reduced to 48 mesh in the secondary grinding department, which consisted of eight Marcy rod mills, operating in closed circuit with 6-ft. Dorr circulating classifiers. The flotation department, comprising sixteen rougher-cleaner cells of the Callow pneumatic type, produced a concentrate assaying 8 per cent copper, 20 per cent insoluble, and 30 per cent iron, about 48 per cent of the total concentrate. Eighty finishing tables, taking the tailing from flotation, completed the concentrating process by making a product assaying 4 per cent copper, 20 per cent insoluble, and 30 per cent iron. Subsequent treatment of these products —such as thickening and filtering—was purely mechanical, in preparation for shipment. To accomplish this, six 75-ft. Dorr thickeners, five 14-ft. Oliver filters, and four Blaisdell settling tanks were in use. In addition, a 200-ft. Dorr thickener was used to dewater the tailing. At this time, a recovery of 88 per cent of the total copper and a ratio of concentration of four to one was made.

Early operation indicated the desirability of a removal of more pyrite and insoluble, in view of the growing depletion of siliceous copper ores from the mines. The economic benefits to be derived by the production of a higher-grade concentrate would result from a saving in freight on shipments, reduction in smelting costs on a smaller tonnage of concentrates, and a reduction in smelter slag losses owing to the partial removal of slag-forming constituents. In concentration, these steps involved: (1) eliminating all gravity processes; (2) sufficient fine grinding not only to separate mineral from gangue but also sufficiently fine to separate the copper minerals from pyrite; (3) changes in the flotation flow sheet and rearrangement of roughers and cleaners, and (4) changes in character and amount of flotation reagents. The effects of selectivity and insoluble elimination are reflected in the many concentrator improvements which have been made since the beginning of operations, a marked reduction being noticeable in the amount and character of equipment in actual use. This applies not only to the equipment used in the concentrating process proper, but also to the supplementary equipment, including thickening and filtering apparatus. These improvements are best shown by an actual comparison, step by step, of the original and present flow sheets shown on the following page.

Those factors having a direct bearing on the simplification of flow sheet may be included under four heads. These are: (1) Elimination of all gravity processes; (2) improved classification and fine grinding; (3) the use of improved reagents, especially xanthate; (4) the successful development of the Forrester-type flotation apparatus to meet local conditions. The advantages resulting from the elimination of tables are lower operat-

A paper delivered at the foremen and bosses' dinner of the Copper Queen Branch, Sept. 19, 1929.

Original Flow Sheet	*Present Flow Sheet*
8 Primary rod mills 6x12 ft., feed 1¼-in.; discharge	{ 14 mesh { 45%—200
4 Desliming classifiers, 8x16 ft.	8 Dorr bowl classifiers, 15 ft. diameter
40 Roughing tables	
8 Dewatering classifiers, 4x18 ft.	
8 Secondary rod mills, 6x12 ft., discharge 48 mesh	8 Secondary ball mills, 6x12 (Conv.) ft., discharge 65 mesh
8 Circulating classifiers, 6x23 ft.	
16 Callow Inspiration-type flotation rougher cells \	10 Forrester combination—cleaner-rougher cells
16 Flotation cleaners	
80 Finishing tables	
4 Concentrate thickeners, 75 ft.	2 Concentrate thickeners, 75 ft.
5 Oliver vacuum filters, 14 ft.	1 Oliver vacuum filter
4 Blaisdell settling tanks	

ing costs as well as improved metallurgy. Of major importance in the fine-grinding program was the installation of bowl classifiers. By means of this intermediate classification approximately 50 per cent of the primary mill discharge, which is finished material, is diverted to flotation, thereby reducing to a large degree the tonnage treated by the secondary mills.

As the degree of grinding done in a roller mill is a function of the area of the grinding surfaces, the management decided to substitute balls for rods as the grinding media of the secondary mills. This resulted not only in finer grinding but also in a reduction of power and steel consumption, and improved over-all mechanical conditions. With the flotation feed ground sufficiently fine so that 90 per cent of the mineral will pass a 200-mesh screen, a satisfactory separation of the finely disseminated chalcocite and pyrite has been attained. Of especial interest in this regard are the results of a microscopic analysis of the tailings for a recent month's operation. The tailing assaying 0.19 per cent copper was made on a 1.9 per cent total copper feed, giving a recovery of 91 per cent.

Chalcocite and covellite, the chief copper-bearing sulphides, account for 51 per cent of the total tailing copper. The balance of 49 per cent as oxide copper consists chiefly of cuprite and melaconite. Of the theoretically recoverable sulphides, 77 per cent is found in the free state, only 6 per cent associated with pyrite, and 17 per cent associated with gangue. This shows plainly that the present grinding affords an efficient mechanical separation of the sulphide copper and iron particles. Xanthate, in replacing the coal tars, which made a bulky float, introduced the idea of selectivity in flotation. This more sensitive reagent, in conjunction with lime used to depress the pyrite, made for much better metallurgical results—a much higher ratio of concentration and, in addition, increased recovery.

The Forrester flotation cell, owing to its simplicity, ease and regularity of operation, and low maintenance cost, occupies a most important place in concentrator operations. This apparatus consists essentially of a V-bottomed trough 50 ft. long, divided by partitions at 5-ft. intervals. Feed enters at one end above the pulp level; tailing discharges over a weir at the other end and froth overflows the lips. Air at 1½-lb. pressure is introduced throughout the cell through ½-in. pipes from a 10-in. header. The resulting agitation of the pulp, aided by pine oil, leads to the formation of a froth in which a definite selective action takes place. This is caused in large part by the action of the xanthate and lime. The sulphide particles, coated with a thin film of reagent, are buoyed up in the froth and overflow the lips of the cell. A large proportion of the pyrite, depressed by the lime and the gangue particles which have become wetted, sinks into the pulp and passes out in the tailing.

A unique feature of the local operation of this apparatus is the introduction of the original feed to the so-called cleaner cells, which produce the final concentrate. The lower cells, picking up much of the mineral remaining in the pulp, make a rougher concentrate, which is returned to the head of the plant to be cleaned. The original design of the Forrester machine, as used at Globe, where it was developed, was not adapted to Bisbee conditions. Many local alterations of minor details, however, have finally brought it to its present state of efficient operation.

To show the results which have recently been obtained, a brief summary of operations in 1928 is shown herewith: Operating time, 95 per cent of total available; dry tons treated, 1,263,279; average daily tonnage, 3,868; assay total copper in ore, per cent, 2.10.

Concentrate: Moisture, per cent, 9.09; dry tons, 159,138; assay total copper, per cent, 15.20; iron, per cent, 33.7; insoluble, per cent, 7.2.

Tailing: Assay total copper, per cent, 0.21; iron, per cent, 5.3; recovery total copper in concentrate, per cent, 91.26; ratio of concentration, 7.93.

Since March 1, the operations have been conducted on a slightly increased tonnage basis, about 4,600 tons being treated daily. This has resulted in a somewhat coarser grind, with a consequent reduction in ratio of concentration. Results for the six months to date, however, show that the recovery has not dropped below the figure set in 1928.

Chemical and mechanical control is of great importance in all concentrating operations. To show the importance of this, all that is necessary is an enumeration of the various phases of control which are practised at present. First of all, daily assays are made on regular-shift samples, taken automatically from all mill products. Daily screenings are made on all products of the grinding department, and hourly titrations are made on the flotation pulp, in which a certain degree of alkalinity must be maintained. Pulp alkalinity ranges from 0.6 to 0.8 lb. of free lime per ton of water. As, in the operation of the Copper Queen concentrator, to keep one of the most important variables—the mill feed—within narrow limits is impossible, concentrating operations must be controlled as efficiently as is practicable, in the light of extreme variations in copper content. To meet this need, a quick colorimetric method for determining copper content has been installed. This has proved to be highly advantageous in keeping a close check on mill operations and detecting abnormal conditions as they arise. Samples are taken hourly and determinations are known within 30 min. Assays that are thus obtained check standard potassium iodide assays within 5 per cent of the copper content.

A well-equipped laboratory is maintained, in which tests are constantly being made on new reagents, on ore samples from those parts of the mine now under development, and on regular mill feed, especially those ores on

which average results were not obtained in the mill. From time to time microscopic analyses of the tailings are made. These serve as a check on grinding and metallurgy, and sometimes give the necessary clew for the solution of a problem which has arisen, chiefly in flotation. In addition, several minor aids to control are available, such as weightometers, by means of which the tonnage treated by each mill is kept uniform, and a method for the determination of pulp density.

At present 140 men are employed. A segregation shows these shifts apportioned to the different department as follows: *Operating:* crushing, 30; milling 70; tailing dam, 10; mechanical department, 30.

The mill is equipped with its own machine shop, in which practically all the necessary repairs are made.

A tabulated percentage distribution of costs for 1928 shows, in percentages of the total: labor and salaries, 30.32; total supplies, 33.52; flotation royalty, 1.88, power, 25.42; water and heat, 7.72; transfers and miscellaneous, 2.83; smelting ore crushed (credit), 1.69.

Tin Producers Reduce Costs of Operation as Consumption Increases

THE RECORD of tin in 1928, in contrast with 1927, indicates a marked increase of consumption, at any rate in the United States, and coincidentally a progressive increase in stocks, according to E. Baliol Scott, who contributes the article on "Tin" in the current issue of *The Mineral Industry,* which was published by McGraw-Hill Book Company. In this connection, continues Mr. Scott, there can be no doubt that production costs are steadily falling in the chief producing centers and that we are approaching pre-war costs. The figures published annually by the Banka administration have borne witness for some time to the progressive reduction of costs there to a very low figure.

In the Federated Malay States tin-producing areas, with their enormous number of independent producers and great variety of working conditions, to get any comparable data has been difficult, but the writer finds among engineers, smelters and those most closely familiar with the conditions in the industry today, and in the past, a consensus of opinion that the average cost of working is a little above pre-war condtions. Indeed, the fact that half-catty (0.666-lb.) ground is now considered worth investigation, taken in conjunction with the price of £200 per long ton for the metal, is the best evidence of the existence of the correctness of this view. The decline is attributable in part to the rapid extension of the output from dredges, but the rapid adoption by the Chinese mines of gravel pumps operated by oil engines, with the prospect of the availability of electric power on a large scale, has undoubtedly brought this class of production into a much more favorable economic position. In Bolivia the enormous increase by the Patiño Mines begun last year is also showing big reductions in the way of working costs.

During 1928 the United States consumed 73,270 long tons of virgin or primary tin, approximately 7.5 per cent more than the 68,198 long tons consumed in 1927. This equaled 41 per cent of the world's production of approximately 178,000 long tons in 1928, according to a report prepared for the U. S. Bureau of Mines. Consumers' stocks of tin amounted to 9,268 long tons on Jan. 1, 1928, and 8,587 long tons on Dec. 31, 1928, a net reduction during the year of 681 long tons. In addition to virgin tin, 12,106 long tons of secondary metallic tin were used by manufacturers of tin products in 1928.

New uses for tin have recently been developed in only minor amounts. Some older uses of tin have been discontinued, although the quantities involved are insignificant. Variation in consumption from year to year parallels the fluctuations in demand for the already well-established tin products. For example, the manufacture of bearing metals and solders for motor cars and trucks required 19,000 tons in 1928, compared with 16,000 tons in 1927; the canning industry continues to require the greater portion of the tin plate and also much solder. Growth in the electrical and other more recently developed industries such as aviation, refrigerators, and radio though affecting total consumption, has made little change in the proportions required for the basic methods of using tin.

New Caledonia Continues to Produce Nickel Despite Ontario Competition

IN NEW CALEDONIA the nickel industry continues to hold its own, says Thomas W. Gibson in the 1928 volume of *The Mineral Industry.* The operating companies are Le Nickel and La Calédonia (formerly Société des Hauts-Fourneaux). The works of the last named are in full operation and the company also produces coal and manufactures coke and briquets. In 1927 it extracted from seven deposits a total of 63,350 tons of nickel ore. The chief deposits are at Bilboquet, A.S., and Tivoli, and preparations are being made to develop the Balaclava mine. Several branch lines of railway have been constructed to serve the mines, and the company is planning the organization of an important mining center at Chamboui, on the east coast; also a railway 13 kilometers in length. With its mining operations in full activity the company should be able to treat a total of 100,000 tons of nickel ore annually in its smelter.

The ore production of Le Nickel in 1927 was 49,473 tons, the chief deposits being the Emma and Zazette. The Ste. Marie mine has been reopened, yielding an ore of approximately 4 per cent nickel content. The mines of Mount Kaala, on the west coast, are also worked, in which the ore contains from 4 to 4.1 per cent of nickel. The company is speeding up its production to reach a monthly output of 6,000 tons of ore.

Nickel matte was exported from New Caledonia in 1928 to a total of 5,428,361 kilos. Of this quantity 101,600 kilos came to the United States, the remainder going mostly to Havre and Antwerp, where the nickel is extracted for the European market.

COMMENT AND CRITICISM

Progress in Europe in the Low-Temperature Carbonization of Coal

To the Editor of "E.&M.J.":

The main objectives of all the processes for the low-temperature carbonization of coal that I have seen and read about on my trip through Europe are: economic production of oils, so as to be partly independent from foreign markets; a semi-coke that is hard enough to stand transportation, burn smokelessly and ignite easily, for home fuel; and production of primary tar.

Much experimenting has been and still is being done, both in England and Germany, with an apparatus such as the rotary kiln, heated from the outside by gas burners; the vertical stationary retort (Coalite, Premier Tarless Fuel, Lampaugh); and retort-like pipes built in gas generators and heated by the escaping generator gases, which are still at a temperature of 700 to 800 deg. C. A certain amount of success has been achieved with the above-mentioned processes, but I think some time must elapse before low-temperature carbonization of coal can be said to be a full economic success.

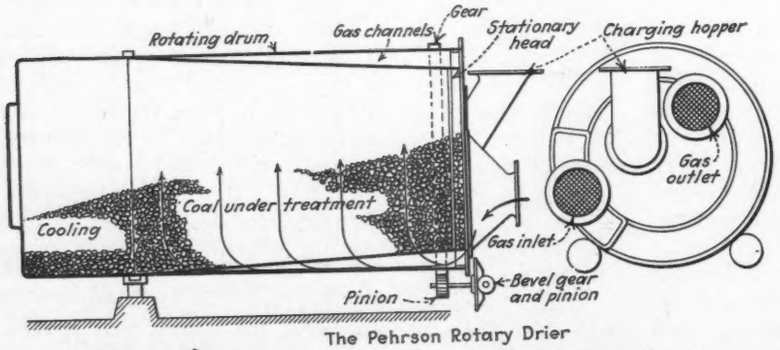
As coal is a very poor conductor of heat, the main difficulty that designers of a low-temperature process have to face is in heating the charge so as to accomplish the highest efficiency of thermal transfer; or, in other words, to see that the cost of labor and fuel necessary to carbonize the coal in a retort is far below the value of the products derived from it. Many methods have been tried. One unique example under consideration is the new Pehrson process, with which promising results were obtained in England and in Sweden.

The process is carried out in two metallic retorts similar to the Pehrson rotary drier, and is divided into two stages. In the first retort, or drum, the coal is dried by being brought to a temperature just below the point at which oils begin to be distilled. After this is accomplished, it is passed through a gas-tight device into the second retort, where its carbonizing is effected by hot gases entering the retort at a temperature of 600 deg. C. This takes place almost immediately, as the coal is already at an elevated temperature and near the distilling point.

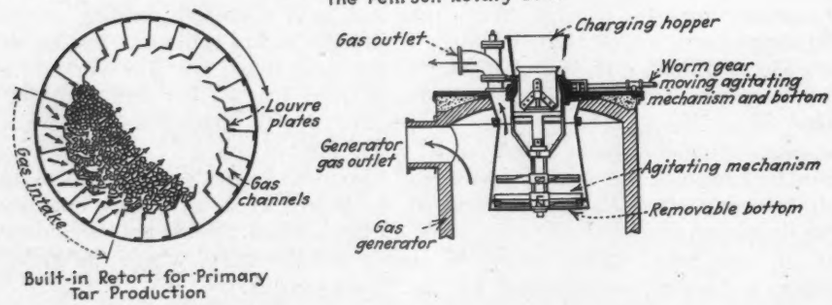
The drier consists of a rotary drum, which has a series of gas channels arranged around its circumference. These are connected to several louvre plates, as shown in the sketch. The louvre plates overlap the gas channels considerably, leaving a gap large enough for the admission of the hot gases needed for carbonizing the charge in the retort, and at the same time they prevent the falling back of material into the channels on which it is resting. According to the shape and the overlapping of the louvre plates, a bed of material deeper than in any other rotary kiln experimented with up to now can be used with a twofold advantage: all the available heat of the introduced gases can be utilized; and, also, there is little wear on the louvre plates. The material rests on them until it reaches the point of gravity, then tumbles, assuring a thorough mixing and a continuous, close, and uniform contact with the introduced hot gases. Thin beds of material go through a sliding motion and effect a greater wear on the cylinder or drum lining.

In the drier described, the head piece, with its gas inlet and outlet and charging hopper, is stationary, and is pressed against the rotating drum, to prevent a leakage of gases and the entrance of cold air from the outside. The gas inlet, as will be seen in the sketch, is a circular duct, widened out and shaped on one end to cover about five gas channels of the rotating drum. When it

COAL plays so important a part in the industrial life of almost every country that mining engineers will do well to keep an eye on recent developments, which indicate that it is a raw material from which many useful and valuable products and byproducts can be made, as well as a fuel. Mr. Huttl, who sends these interesting comments from Czechoslovakia, is well known to readers of *Engineering and Mining Journal* as the author of suggestive contributions on innovations in mine-shop practice in Honduras.



The Pehrson Rotary Drier



Built-in Retort for Primary Tar Production

rotates, several gas channels are always brought opposite the gas inlet. This corresponds with five gaps in the louvre plates on which the charge rests. The gas must pass through it before escape from the drum, and, coming in intimate contact with the charge, thereby loses all its available heat.

Sufficient pressure to force the hot gases at 600 deg. C. through the bed of material is supplied by a main fan near the gas inlet. Removal of the coal gases is effected in the same way, through another fan on the gas outlet of the stationary head. The rotating mechanism is very simple, consisting of a small motor, reduction gear, bevel gear, and pinion. According to reports, excellent results were obtained with the process described, on a hard and semi-coke containing 14 per cent volatile matter.

The Germans seem to be more concerned with the production of oils and primary tar, obtained by heating the coal up to 600 deg. C. It is of a dark brown to port-wine-red color; should be in a liquid state at room temperature, with no segregation of paraffine; have the odor of sulphuretted hydrogen, never of naphthalin; and be of a specific weight between 0.95—1.06 when at 25 deg. C. This tar differs greatly from the ordinary coke-oven or generator tar in both chemical composition and color. Ordinary tar is, as known, nothing other than an overheated product of primary tar, or *urteer*. The other byproduct, the semi-coke, is generally used in Germany for fuel in gas producers.

Thyssen, Felner and Ziegler have large and paying rotary-type kiln plants running in Germany. Another type is the built-in pipe-like retort in gas producers shown in the sketch. This is heated by the escaping gases of the producer, as mentioned before. At the top the retort has a charging hopper and a gas outlet, the bottom of which is removable. It can be worked from outside the furnace, either by hand or automatically, to drop the carbonized coal or semi-coke into the fire chamber of the gas producer as its fuel.

More modern retorts of this type also have an agitating mechanism built in, so as to mix and stir the charge inside and to prevent it from caking. Generally two of these retorts are used on each gas producer. The time needed to carbonize one charge is from 2½ to 3½ hours, depending on the kind of coal used. England, with its supply of cannel coal, containing more than 30 per cent of its weight in primary tar, has, of course, an advantage over Germany, the latter having a much poorer coal, with only 8 to 12 per cent tar content, available for this purpose.

Considering the many thousands of gas producers working in each country that could be equipped with retorts, I am sure that quite a number of thousands of tons of tar and oils could be produced annually. JOHN B. HUTTL.

Graslitz-Eger, Czechoslovakia

Steel Clock Spring Displaces Divining Rod

To the Editor of "E.&M.J.":

The development described in the inclosed cutting from the weekly edition of *The Times* (London) of Aug. 29, 1929, by which an old clock spring handled by a highly sensitive person is used, may be of interest to your readers.

W. ERNEST FRANKS.

San Luis Potosí, Mexico.

The account follows:

"An experiment in gold divination was made on some rough ground at the rear of the Plymouth Museum and Art Gallery last Thursday, under the supervision of the Curator, Mr. A. J. Caddie. The diviner was Mr. Frederick Stone, of Brandis Corner, North Devon, and he successfully located the following objects which had been buried previously by the Curator—a gold chain, a gold bracelet, a piece of gold nugget, and four pieces of rough quartz from the museum collection.

"Mr. Stone's method was to walk over the ground with an ordinary steel clock spring stretched between his hands, and whenever he approached one of the objects, the steel twisted and turned. Even the quartz, which contained very little gold, offered no difficulty, and in one case the diviner was able to say that the quartz also contained copper. From the number of turns Mr. Stone could tell how many feet away the gold lay hidden. The diviner can also find other minerals and springs of water, and the presence of water and the proximity of telephone wires complicated his task last week.

"Mr. Stone, it was stated, was an invalid for twenty years until it was found that he needed insulation. He now wears thick rubber-soled boots and a vulcanite pad under the right foot and enjoys good health, although he experiences periods of lassitude after divining. Up to a few months ago he had never attempted divination, but when tested he found over a dozen gold and silver articles that had been buried in a garden at Brandis Corner, some of them 6 ft. below the surface. His reactions to electrical influences are abnormal. He cannot, for instance, use a telephone or a pair of wireless headphones without receiving a shock."

Cyanide Process for Gold-Copper Ore

To the Editor of "E.&M.J.":

I have read with interest the article on "Treating Cupriferous Precious-Metal Ores," by A. C. Halferdahl, in *Engineering and Mining Journal* of Aug. 31, 1929, and would like to draw attention to the fact that, in 1902, I was granted U. S. Patent No. 699.108, for the extraction of gold from cupriferous ores, to which the writer of the article does not refer. This process consists of adding some cyanide to a solution of ammonia, care being taken that a considerable excess of ammonia is present. When the cyanide-ammonia liquor comes in contact with the oxidized copper mineral present in the ore, it forms cupri-cyanide. In contact with gold this forms aurous-cyanide and cupro-cyanide. All these compositions are very soluble in ammonia.

Reference to Jarman and Brereton's article on the cyaniding of cupriferous ore and tailing (*Trans.* I.M.M. Vol. 14, p. 289) will disclose the fact that the investigation of such ores was made by them and the results by my process are shown to be very good.

In an article by Louis Janin, Jr., in *Engineering and Mining Journal* of Dec. 20, 1902, is also given an account of the working of the process and some results secured in southern California.

Mr. Halferdahl's statement that ammonia-cyanide treatment of ores has not gone beyond the laboratory stage is more or less true, but the reason is not easy to define. Only oxidized ores are amenable to this treatment; sulphide ores form a large amount of sulpho-cyanide, and thus increase the cyanide consumption. If the copper and gold ore be treated by flotation, roasting the flotation concentrate would make it amenable to ammonia-cyanide treatment. Details of the process were published more than twenty years ago, but no one has taken it up, and there does not seem to be much call for it.

Silver does not react in this way; the silver mineral dissolves in the cyanide-ammonia solution as in ordinary cyanide.

The cyanide process has been developed in its mechanical applications, but after the first few years very little has been published from the chemical point of view. BERTRAM HUNT.

London.

Precision in Electrometallurgical Terminology

To the Editor of "E.&M.J.":

I noticed the other day, in one of your journals, a letter on some of the terms used in metallurgical papers. This particular letter objected to the terms "tank house" and "electrolytic tanks." The gentleman stated that he thought that they should be called "electrolytic cells." I wonder if he would call the tank house a "cell house," a term used in penitentiaries. I do object to any other term for tank house. METALLURGIST.

New York.

[Objection such as this, from a responsible quarter, will be respected. However, *Engineering and Mining Journal* has not suggested "cell house" as a substitute for "tank house." In fact, in the editorial referred to, the contention was advanced that "No more need exists to feature 'tank house' when referring to electrometallurgical operation than to use a term such as 'vat house' when discussing lixiviation, or 'furnace house' when speaking of smelting. A tank is a vessel for the storage of a liquid. A unit containing electrodes and an electrolyte is a cell." *Engineering and Mining Journal* would be glad to publish objections from other readers.—EDITOR.]

Book Reviews

Discovering the Mesabi

SEVEN IRON MEN. *By Paul de Kruif. New York: Harcourt, Brace & Company. Pp. 241. Price $3.*

LAKE SUPERIOR people may know the story of the Merritts—the iron men of this volume—through whose dogged and unrelenting search for ore the deposits of the Mesabi Range became available to civilization rather earlier than they would otherwise have been. But the world at large does not, and it is fitting that the fascinating tale of bull-headed conviction, courage, and persistence, with their tremendous results, should be entered in the record of American history, as Doctor de Kruif has done. Truly, the country at large, and Minnesota in particular, owes much to these pioneers.

As the author weaves his tale, admiration for the sturdy characters of these men of iron mingles with regret that they did not profit more by their discovery. Surely they earned the right to wealth, if explorers ever did. They were more honest than shrewd, however. The cynic will find food for thought in contemplating how others got fabulous riches for relatively a song. If the Merritts were short on business acumen, those who profited most appear to have been none too farsighted. One is led to speculate as to how different the developments in the iron and steel industry might have been had not "Lon" and his brethren appeared at the psychological moment with their gift of rich and ridiculously cheap iron ore. The author stops short of cynicism, however, but the reviewer suspects that at times he has had difficulty in refraining from stronger speech.

Doctor de Kruif cannot leave microbes alone. He introduces them even in the story of the Merritts. As the reader may remember, he is the author of "Microbe Hunters," and is a bacteriologist. Perhaps it was Gallionella—the "iron-eating microbe," toiling for numberless millenniums to lay down the iron of the Mesabi — that first caused him to set his feet on the Merritts' trail and follow them in their wanderings. He does not say so, but he dwells on Gallionella as the ultimate cause of the things that he recounts and it is not unlikely that this long-named "sub-visible being" was likewise the first cause of the story itself. A. H. H.

METALLURGICAL BULLETIN. *The General Engineering Company. Salt Lake City, New York, Toronto, and London. Pp. 127.*

COMPARATIVELY few publications issued for free distribution, aside from those published by governmental agencies and scientific societies, are worthy of a place on the technical bookshelf, as is this, though of course many of them are valuable additions to the catalog file. This so-called "Bulletin" is more properly an abridged metallurgical engineers' handbook, and a most informative one it is, too. Some space is naturally given to the *raison d'être* and accomplishments of the publishing firm, but most of the contents has no advertising flavor whatever. Included are flow sheets of typical cyanide and flotation mills, also giving installation and operation costs in considerable detail for plants of various capacities; costs of insurance and various kinds of transportation; smelter ore purchase schedules; data on reagents and on power and water consumption, and alkalinity control of flotation plants; pulp calculations; and a large amount of tabulated and textual data on the various mechanical and electrical equipment used in ore dressing, concentration, and hydrometallurgy. The only feature that this reviewer feels called upon to question is the weird map of Salt Lake City in the inside front cover; though reasonably familiar with the town, this left us staggering. Readers of *Engineering and Mining Journal* may have a copy of this book on request to the publishers, and the demand should certainly be large.

E. H. ROBIE.

ENGLISH AND SCIENCE. *By P. B. McDonald. New York: D. Van Nostrand Company. Pp. 192. Price $2.*

"IN THIS modern age of science and industry we are compelled to think clearly and write concisely," says Professor McDonald in the preface to this readable little volume. Editors, though perhaps wishing the compulsion were more in evidence, welcome efforts such as the author's to effect a reform, especially among those concerned with and responsible for the interpretation of the findings of science and their application to industry.

The qualities of simplicity and conciseness have been given primary consideration by Professor McDonald, and few will dispute the logic of his preference in this respect. General agreement will be voiced as to the importance of written records—a subject discussed in pleasing and convincing manner in the first chapter. Suggestions on the preparation and the presentation of a technical paper follow. The section on punctuation in this chapter is short, but the reader will find that the subject is dealt with again in a later part of the book. A recommendation in regard to the use of the comma—"Reading a sentence aloud and noting the pauses or changes in the voice are a good test for the comma"—is not happily phrased. Moreover, such a test may well suggest the recasting of the sentence and the avoidance of comma punctuation. The advice that "Hyphens should be used freely . . ." is dangerous. One mark of a careless or poorly educated writer, as Professor McDonald avers, is a disregard for hyphens; but equally true is the contention that restraint in this particular is necessary to avoid overstepping the bounds of common sense and the limitations of accepted typographic style.

In the volume under review will be found sound advice on the composition of reports and letters. Correct and concise language is preferable to an exhibition of pomposity and ornateness, and contrast is afforded by separate chapter treatments of such characteristics. The book concludes with advice on the mastering of words such as cliché, hedonist, pachyderm, eclectic, and stet. An opinion is offered on preferences in expression; also on suitable material for reading study.

C. N. HULBURT.

GEOLOGY OF FLORIDA. *By C. W. Cooke and Stuart Mossom. From the Twentieth Annual Report of the Florida State Geological Survey, Tallahassee. Pp. 200.*

CO-OPERATION between the state and federal geological surveys has resulted in the production of this volume, Mr. Cooke representing the latter of the two bodies. Twenty years ago, a report on Florida geology was issued by the United States survey. It has become out of print, however, and naturally is twenty years old so far as facts are concerned. For this reason the new bulletin will be welcome to all those whose interest in the state extends beyond land booms, extinct and dormant, winter resorts, orange growing, and other things for which Florida is best known to the public.

OUTLINE OF METALLURGICAL PRACTICE. *By C. R. Hayward, New York: D. Van Nostrand Company. Pp. 612; illus. Price $7.50.*

As explained in the preface, this volume has been compiled for a quick reference book of information on extracting and refining most of the metals, and to assist students who are starting their metallurgical studies with no practical experience and little or no knowledge of the subject and its literature, although an acquaintance with common chemical reactions on the part of the reader is presupposed.

Personal Notes

H. S. Denny, Jr., of Toronto, sailed from New York on Oct. 3, for Salvador.

R. M. Atwater has returned to New York City from a trip to several Western mining camps.

C. H. MacDonald has been elected a vice-president of the Colorado Fuel & Iron Company.

Reno H. Sales, chief geologist for Anaconda Copper Mining, at Butte, Mont., is in New York City.

H. V. Ingalls, formerly of Mullan, Idaho, is in charge of operations at the Clipper-Bullion mine at Shoup, Idaho.

John H. Haiber has been appointed superintendent of the mine and mill for Whitedelf Mining, at Clark Fork, Idaho.

Burr Wheeler, general manager of operations at Chuquicamata, Chile, for Chile Exploration, is in New York City.

W. L. Baillieu, chairman of the board of directors of the Electrolytic Zinc Company of Australasia, is now in England.

George H. Garrey is engaged in geological map-making in the Lime Bluff Mining district, near Pitkin, Gunnison County, Colo.

J. H. C. Waite has been elected a director of Amulet Mining, operating in the Rouyn district of Quebec. He succeeds **A. A. McKay.**

Capt. **J. G. Ross,** of Montreal, consulting engineer to the Asbestos Corporation, was recently in New York City on professional work.

I. J. A. Diamond, of Johannesburg, accompanied by Dr. **D. Diamond,** has left on a professional visit to northern Transvaal and Swaziland.

J. G. Baragwanath, vice-president of the Pardners Mines Corporation, sailed for Europe on Oct. 4, expecting to return in about three weeks.

W. C. Browning and **F. W. Snow,** of Los Angeles, have sailed for Venezuela, where they will be engaged for two months in a mine examination.

Louis D. Huntoon is examining properties in the Kenora gold district, along the north shore of Lake Huron. He expects to be in Toronto on Oct. 19.

M. E. Fisher, ore-purchasing agent of American Smelting & Refining, at Wallace, Idaho, was married to Miss **Myrta Blake Berry,** at Las Vegas, Nev., on Sept. 10.

J. Verdussen has returned to the Belgian Congo, to take up the duties of assistant superintendent of the leaching plant of Union Minière, at Panda, Katanga.

Frederick G. Clapp, consulting petroleum engineer, announces his new European address as No. 28 Rue Poussin, Paris XVI. His cable address remains "Consultoil."

Anton Sorenson, of Opportunity, Wash., has been appointed superintendent of the Riverside mine of Omo Mines Corporation, in the Duncan River district of British Columbia.

Lotan C. Read, of Sandusky, Mich., accompanied by **A. J. Gilbert** and **H. L. Pearl,** both of Grand Rapids, Mich., are in New York on business incidental to the financing of a mining property.

William Kent, formerly smelter superintendent at Copper Cliff, Ont., is now connected with Bridgeman, Bates & Company, a New York Stock Exchange house, at 2 East 57th St., New York City.

R. S. Dean, of Chicago, has been appointed chief engineer of the metallurgical division of the U. S. Bureau of Mines. For the last ten years, Mr. Dean has

R. S. DEAN

been in charge of metallurgical development for the Western Electric Company, at the Hawthorne plant, in Chicago. Before his association with Western Electric, he was engaged in metallurgical research for Anaconda Copper Mining and for American Zinc, Lead & Smelting.

George H. Rupp, formerly mining engineer on the Calumet & Hecla staff at Calumet, Mich., is now in charge of iron mines and limestone quarries for the Colorado Fuel & Iron Company, of Denver and Pueblo, Colo.

Daniel Murphy, formerly superintendent of the Tamarack & Custer Consolidated mine, is in charge of reopening the United Metals property, on the south side of Canyon Creek, in the Coeur d'Alene district of Idaho.

H. L. Day has been appointed assistant mine manager of Tamarack & Custer Consolidated, operating in the Coeur d'Alene district of Idaho. **W. H. Simons** has been appointed mine superintendent; **E. F. Thatcher,** master mechanic.

Charles R. Wraith, assistant superintendent of the smelter of Anaconda Copper Mining, at Anaconda, Mont., has been appointed manager of the Roan Antelope smelter, which will be built in the N'Dola district of Northern Rhodesia.

George E. Lynch, of Los Angeles, was recently in New York, after an extensive professional tour in the Northwest United States and Canada. He is returning to Los Angeles by way of the mining regions of the South and the Southwest.

Alan Bateman, professor of economic geology at Yale University and editor of *Economic Geology,* has returned to New Haven after a trip to the copper fields of the Belgian Congo and Northern Rhodesia. In Northern Rhodesia he was engaged in professional work. Later, Professor Bateman attended the International Geologic Congress in South Africa.

Col. **C. D. H. MacAlpine,** president of Dominion Explorers, and his party are still lost in the barren area of northern Canada, near Bathhurst Inlet. They have been missing since Sept. 8, when they left Baker Lake in two planes. An active search is now being conducted by several planes, but the approach of winter is making exploration difficult. The party is said to have had sufficient food for a month in the two planes that were used.

OBITUARY

H. Cole Estep, vice-president of the Penton Publishing Company, died on Sept. 30, in Cleveland.

A. D. Marshall, of Wallace, Idaho, died on Sept. 28. Mr. Marshall was 75 years old. He had lived in the Coeur d'Alene district for 30 years. He was a director of Eureka Mining & Milling.

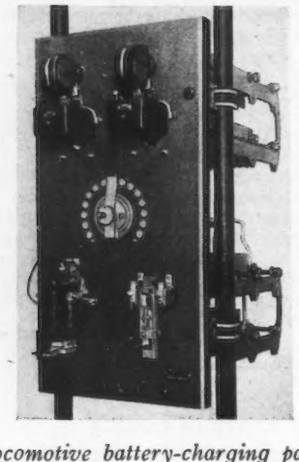
William F. McKay, discoverer of McKay hill, in the Beaver mining district, Yukon territory, and interested in several claims in the Keno Hill district, died recently after a long illness. Mr. McKay was 76 years of age, and had been in the Yukon territory since he went to the Klondike in the stampede days of 1898.

Karl T. Sparks, director of the central mines rescue station for the Coeur d'Alene district, at Wallace, Idaho, died on Oct. 2, in Wallace. He received his degree as a mining engineer from the Montana State School of Mines. Soon after graduation, he joined the U. S. Bureau of Mines and spent several years making geological surveys near Fairbanks, Alaska. Transferred to the mine rescue and safety division, Mr. Sparks acquired a reputation for efficiency and resourcefulness. In 1923 he accepted the position offered by the Coeur d'Alene operators, and was placed in charge of a mine-rescue car stationed in Wallace, for the protection of the entire district. Mr. Sparks was 36 years of age at the time of his death.

Anaconda Installs New Charging Panels for Battery Locomotives

By B. L. Snoddy
General Electric Company, Butte, Mont.

IN THE last eight months the Anaconda Copper Mining Company has installed 42 special battery-charging panels. These will be used in charging the batteries on the company's 5-ton storage-battery locomotives and 1½-ton trammers from a 250-volt source supplied by 75-kw. motor-generator sets.



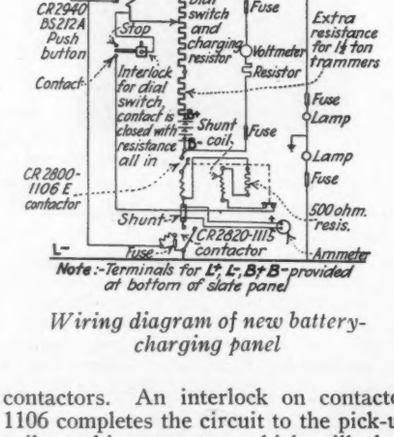
Locomotive battery-charging panel, showing 15-point dial switch and other equipment

On a 5-ton locomotive the battery consists of 105 A5 Edison cells. The battery of a 1½-ton trammer has 32 of these cells. When charging the battery for a trammer, an extra resistance is employed in series with that used when charging a 5-ton locomotive battery. These special panels were built in the Salt Lake City service shop of the General Electric Company. They are illustrated in the accompanying photographs and connection diagram. Each includes the following:

1 slate base, 30 x 16 x 1½ x ¼ in., mounted on pipe supports.
1 cast-iron grid resistor, 2.28 ohms, 75/38 amp.
1 80-amp. series contactor which is closed by its potential coil at a predetermined voltage and is held closed by the series coil.
2 80-amp. line contactors with 125-volt coils connected in series to operate similarly to a double-pole contactor and break both sides of the line.
1 15-point dial switch with interlock to prevent the closing of the series contactor until the resistance is all cut in. The switch is used to vary the charging current, which depends upon the condition of the battery.
1 instantaneous automatically reset overload relay.
1 flush-type voltmeter, 0-300 volts.
1 flush-type ammeter, 0-100 amp.
1 "start" and "stop" push-button station.
2 ground detector lamps.
1 inclosed fused cutout with fuses for lamp circuit.
1 fuse cutout with fuses for voltmeter circuit.
1 fuse cutout with fuses for control circuit.
2 porcelain lamp receptacles mounted back of steel front and under meters.
1 inclosing case with roof projecting 6 in. on the front and 4 in. on the sides.

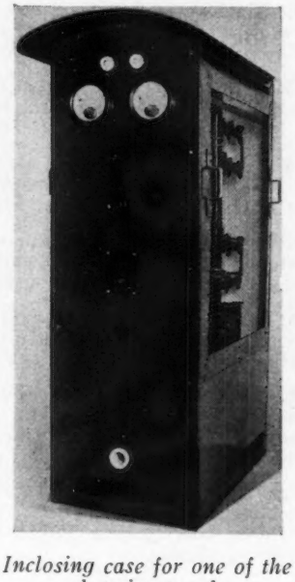
The inclosing case, shown in one of the cuts, is made of angle-iron frame and has a sheet-steel front and top. The sides are made of meshed screen and sheet steel and are readily removed. The back is open. Over-all dimensions of the complete unit are 68 in. high, 22 in. wide, and 34 in. deep. The handles for removing the sides project 2 in., making the total over-all width 26 in.

When the "start" button is pressed, the line contactors 1115 (see the diagram) will close and the holding circuit is made by an interlock on one of the



Wiring diagram of new battery-charging panel

contactors. An interlock on contactor 1106 completes the circuit to the pick-up coil on this contactor, which will close providing the charging voltage is sufficiently high to start charging the battery. The amount of charging current is varied by changing the value of the resistance in the charging circuit by means of the dial switch. If the voltage of the charging source should happen to fall below that of the battery so that there could be a reversal of current, the series contactor would drop out when the current reached a sufficiently low value before actually reversing. In this way reverse-current protection is secured, as this contactor will not pick up again until the voltage is high enough to enable the battery to be charged. The relay (CR2820-1024B) provides instantaneous overload protection and is automatically reset. However, once the contactors open because of overload, the "start" push button must again be



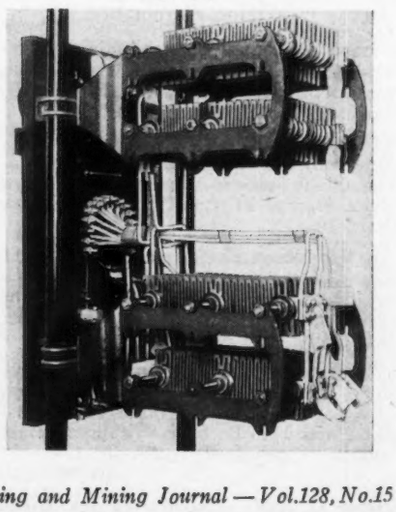
Inclosing case for one of the charging panels

pressed to start charging again. The charging can be stopped at any time by pressing the "stop" button or by the operation of an ampere-hour meter installed on the locomotive.

The ammeter shunt is connected in the negative line so that, in case of a ground, the ammeter will not be burned out.

The voltmeter is connected so that it will show the battery voltage when the operator plugs in, and the charging voltage when he pushes the push button to start charging.

Rear view of battery-charging panel



Conditions in the Butte mines are severe, and it is necessary to furnish a panel with a roof to protect the equipment from dripping water. The steel front and meshed screen sides protect the operators from coming in contact with live parts. Inasmuch as the panel is mounted with its back against the wall, to protect the back with a screen is not necessary.

Gravity Flotation Process Uses Heavy Liquid Separation

A NEWLY developed method of gravity flotation utilizing a heavy liquid for the purpose has yielded excellent results in laboratory tests and is being applied in a 50-ton machine built expressly for commercial test purposes. Its simplicity, extremely low cost, and ability to treat large tonnages rapidly are indicated in tests on various kinds of ores.

The liquid used is acetylene tetrabromide, a product of the Delaware Chemical Engineering Company, Wilmington, Del. It has been applied to ore dressing by Major A. Nagelvoort, research engineer of the company, in co-operation with the research staff of the Michigan College of Mining and Technology, at Houghton.

At Wilmington, iron and manganese ores are being treated in ore-dressing tests, and at Houghton attention is being given to copper-bearing materials, smelter residues, the cleaning of copper concentrates, lead and zinc ores and cencentrates, and minor metals. A typical result of beneficiating iron ores is 50 per cent or more iron in the concentrate and 6 to 10 per cent in the tailing, depending on the degree of subdivision of the iron.

Acetylene tetrabromide has a specific gravity of 2.97 to 3. It can be diluted with kerosene as required. It does not mix with water, nor does it evaporate very rapidly. The solution is used to separate ores in which the specific gravity of the valuable constituent is greater than that of the liquid, and that of the waste material is less than the specific gravity of the compound. Quartz has a specific gravity of 2.6 and quartz is the major gangue rock. Specific gravities of gangues in general vary from 2.4 to 2.8, and those of metals and their compounds are generally greater than 3.

In this method, fine crushing is said to be detrimental rather than desirable. The process works better on coarser sizes, those above 10 mesh, at the present stage of experimentation.

An experimental 7-ton machine had been in operation previous to the use of the 50-ton unit recently completed. Water equal to or greater than the depth of the liquid, and sufficient to wet the ore, floats on top. This wetting has been found to prevent the heavy liquid from adhering to the ore particles after treatment. A screw conveyor or drag removes the gangue from the water and a similar contrivance retrieves the concentrate from the bottom.

Where the Internal-Combustion Engine Locomotive Shines

FOR underground haulage the electric locomotive, of the trolley or storage-battery type, has no serious competitor. The internal-combustion engine is obviously unfitted for such service in the vast majority of mining operations, on account of the exhaust gases that it produces. For surface work about a plant, however, quite a different story may be told. Points in favor of internal-combustion engine drive for plant locomotives have recently been outlined by a manufacturer of this type of equipment, although without reference to his own line. A résumé is presented in the following:

Internal-combustion engines are used to power locomotives, both of the gear-driven and electric-driven type. Because of the economies they afford they are worthy of mention. Their use is not limited to the plant yard, however. Some railroads use them for switching, for short-haul road work, and for shop and yard switching. A locomotive driven by an internal-combustion engine requires no bulky and heavy tender to carry fuel and water. All of the fuel it needs is easily stored in a small tank which is part of the unit. No fireman is required.

The complex structure of the steam locomotive is lacking. Great power can be developed in a small engine of the internal-combustion type. This fact has long been recognized, and because of it much engineering skill in the last twenty years has been devoted to developing the gasoline engine. As a result of the efforts and money expended by many different agencies, the internal-combustion engine has been brought to such a point of development that it is now the most efficient power unit the world has seen. Small and compact, yet able to carry fuel for a long period; clean, reliable, and capable of delivering maximum power at a second's notice, it is the final expression of concentrated thought.

These are familiar facts, but few apparently realize just what they mean in the locomotive field. For instance, it does not seem to be generally appreciated that, pound for pound, a gas or oil locomotive will exert a greater starting torque or pull than a steam locomotive. Actual tests have shown this advantage in power to be so great that a 30-ton gasoline locomotive will exert a greater starting pull than a 45- to 50-ton steam-driven unit. In addition to this gain in power is the fact that the former will work more economically than the steam locomotive.

Where space is limited or at a premium, the compactness of design makes gasoline and oil locomotives of particular value. For this reason they are frequently used by plants and factories in yard work.

On work involving the use of temporary tracks, or for any hauling over uneven tracks with sharp curves and deep grades, gasoline and oil locomotives are unsurpassed. They possess great track-riding ability because of their comparatively small size, low center of gravity, and short wheelbase. These factors combine to give them an equilibrium not easily disturbed. On some locomotives, still another factor is added in a cross equalizer that maintains the rail load in constant balance, and makes the locomotive capable of riding the roughest track.

The gasoline or oil locomotive will work more economically for various reasons. For one thing, it requires the service of but one operator, who needs no more skill than that possessed by a careful truck driver. No licensed engineer is required and no fireman. Moreover, there is no stand-by expense and no need of maintaining a fire and keeping up steam.

Finally, there is the important item of fuel economy, which results largely from the high thermal efficiency of the gasoline engine. This efficiency is 30 per cent, as compared with an efficiency in the steam locomotive of only 8 to 12 per cent. Moreover, these percentages are not of absolute value for comparative purposes, inasmuch as two entirely different kinds of fuel are being discussed, and a fair comparison on a percentage basis cannot be made without reducing the two different fuels to terms of thermal units. This is not practicable because of the wide differences in various grades of the two kinds of fuel. However, the fuel economy of gasoline and steam locomotives can be compared in terms of dollars and cents.

A gasoline and oil locomotive that will do the same amount of work as a 50-ton steam locomotive can be operated at a daily cost, for fuel and oil, of $5 to $7. For fuel alone the steam locomotive will cost $15 to $20 per day. It is because of this economy of operation that locomotives burning gasoline and oil are found in use in places where coal and electricity are readily available.

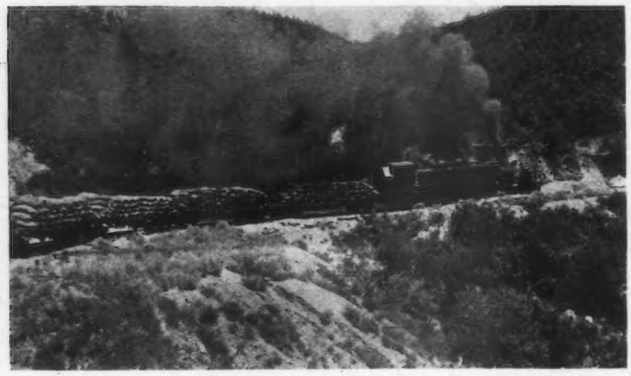
Moreover, a side-rod steam locomotive does not apply its power on low speed as evenly or with as steady torque as does a gear or oil-electric locomotive. Therefore, at low starting speed a gas or oil-electric locomotive will exert a greater tractive effort and drawbar pull.

A pamphlet discussing this subject has recently been distributed by the George D. Whitcomb Company, of Rochelle, Ill.

Locomotive Haulage Still Essential in Large-Tonnage Transport of Mine Products

Single-Expansion Articulated Equipment Effects Marked Economies in Moving Gilsonite Over Mountainous Line

LOCOMOTIVE HAULAGE, owing chiefly to its independence of outside sources of power and its ability to handle heavy tonnages, continues to be an essential method throughout the world of economically transporting mine products. Particularly is this true in isolated districts, where unusual or severe conditions necessitate the employment of steam equipment. Such expedient use of locomotive haulage to solve a difficult ore-transport problem is exemplified by the Uintah Railway, a 3-ft.-gage line extending 70 miles in a northerly direction from Mack, Colo., a point on the Denver & Rio Grande Western Railroad, to Watson and Rainbow, Utah. The line was constructed for the specific purpose of transporting gilsonite which is mined in the vicinity of the Uintah Mountains in Utah.



A trainload of gilsonite being hauled up a 5 per cent grade

The most difficult section of this line is that crossing the Roan or Book plateau, which is a high ridge separating the valley of the Colorado River on the south and the Uintah basin lying to the north. This ridge is crossed at a maximum elevation of 8,437 ft. above sea level. In climbing it from the south side, a rise of 2,012 ft. is made in 5.9 miles, the grade for a large portion of this distance being 7.5 per cent. On the north side are 6.7 miles of almost continuous 5.0 per cent grade. In a distance of 12 miles, which include the steepest grades on the line, are 233 curves, varying from 4 to 66 deg. The grades are compensated, and on the 66 deg. curves the rails are spread $\frac{7}{8}$ in.

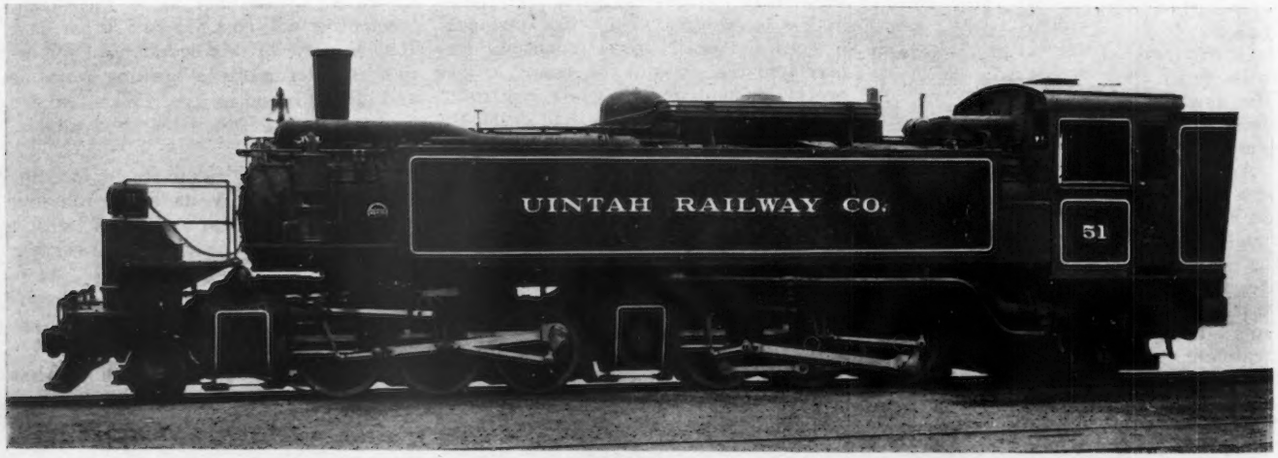
The two articulated locomotives employed by the Uintah Railway were recently adopted to replace geared equipment that, in comparison, was slow in operation and expensive to maintain. These new locomotives are a tank type, as shown in the accompanying illustrations, and carry the water supply in two side tanks. The fuel, which is a good grade of bituminous coal, is placed in a bunker back of the cab. Owing to the excessive curvature on the line, design of the running gear presented a difficult problem. Liberal clearances were necessary, and, in addition to lateral movement of the front frames with reference to the rear, the leading trucks have a swing of $6\frac{3}{4}$ in. on each side. In spite of the narrow gage and the fact that the front frames are between the wheels, these locomotives have proved to be more stable on the track than the smaller type previously used.

One of the Uintah locomotives on a 66-deg. curve

A superheater is used in the design of the locomotives, and steam is conveyed from the header to the rear cylinders through two external pipes that are heavily lagged and pass through the top of the smokebox. Just above the rear steam chests, the pipes branch, but further on unite on the center line in the form of a flexible pipe that conveys live steam to the cylinders of the front unit.

The locomotives are each rated to handle 145 tons on a grade of 7.5 per cent and 240 tons on a grade of 5.0 per cent. In service, each can handle as much tonnage per train as two of the geared locomotives and can make the run in about half the time required formerly. The new locomotives are a 2-6-6-2 type and were designed and built by The Baldwin Locomotive Works, Philadelphia, Pa.

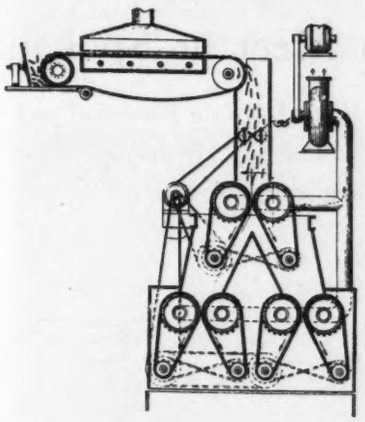
The single-expansion 2-6-6-2 type locomotive used on the Uintah Railway



PATENTS

MICA-SEPARATING MACHINE. No. 1,722,082. July 23, 1929. L. T. Frederick, assignor to Chicago Mica Company, Valparaiso, Ind.

A mica-treating machine in which the leaves of mica are separated by an outward-pulling action exerted on the mica by a series of belts.



Illustrating Patent No. 1,722,082

CLASSIFIER. No. 1,726,404. Aug. 27, 1929. F. B. McConville, Princeton, British Columbia, Canada.

A hydraulic ore classifier of the rake type.

VIBRATING SCREEN. No. 1,724,007. Aug. 13, 1929. J. Crabb, Sr., Joliet, Ill.

A rocking motion is imparted to the screen by numerous arms that extend from the screen to rotating drums.

FILTER PRESS ATTACHMENT. No. 1,727,832. Sept. 10, 1929. R. Kogure, Kawasaki, Kanagawa Ken, Japan.

An apparatus for opening and shutting a filter press.

REDUCING ZINC ORES. No. 1,728,094. Sept. 10, 1929. H. Wittek, Beuthen, Germany.

A process for reducing zinc ores that consists of treating the ores with carbide in a stream of nitrogen.

LAMP ATTACHMENT. No. 1,725,182. Aug. 20, 1929. A. Dorsey, Martins Ferry, Ohio.

A device for attaching a miner's acetylene cap lamp to a cap.

ZINC SULPHATE. No. 1,725,865. Aug. 27, 1929. F. Johannsen, assignor to the Firm Fried. Krupp Grusonwerk Aktiengesellschaft, Magdeburg-Buckau, Germany.

A process of producing zinc sulphate from sulphidic ores and metallurgical products containing zinc.

TREATING COPPER SLAG. No. 1,728,095. Sept. 10, 1929. S. Yoshimoto, assignor to Torataro Okumura, Kobe-Shi, Hyogo-Ken, Japan, and to Seishichiro Nakamura, Hyogo-Ken, Japan.

Copper slag is moulded into block form, and when it has cooled to a red heat a mixture of powders of sulphur, mica, iron, and bran is applied to the block. The block is then annealed by slow cooling.

ORE JIG. No. 1,726,388. Aug. 27, 1929. R. L. Dennison, Kansas City, Mo.

Design for a jig of the Harz type.

SMELTING FURNACE. No. 1,724,490. Aug. 13, 1929. C. H. Mace, Denver, Colo.

A design for a blast furnace.

SMELTING FURNACE. No. 1,724,340. Aug. 13, 1929. H. L. Charles, Kent, Wash.

A reverberatory smelting furnace having vertical end and side walls and cooling means at the firing end.

DETECTING DEPOSITS. No. 1,724,794. Aug. 13, 1929. W. W. Davis, Great Neck, N. Y.

A method of detecting ore deposits by means of Hertzian waves.

RECOVERY OF METALS. No. 1,728,735. Sept. 17, 1929. R. Rodrian, New York, N. Y.

A process for recovering metals from metal-bearing materials by the use of hot alkali-sulphide solutions.

FLOTATION PROCESS. No. 1,723,295. Aug. 6, 1929. A. H. Ney, New York, N. Y.

A froth flotation process employing as a reagent a derivative of thiosulphuric acid, in which the hydrogen atom of the sulphydrate is replaced by an alkyl group.

TREATING OXIDIZED LEAD ORES. No. 1,726,258. Aug. 27, 1929. N. C. Christensen, Salt Lake City, Utah.

Carbonate lead ores are treated for the recovery of lead by a lixiviation method employing the use of a concentrated sodium chloride brine containing ferric chloride.

FLOTATION PROCESS. No. 1,723,243. Aug. 6, 1929. C. P. Lewis, assignor to Minerals Separation North American Corporation, New York, N. Y.

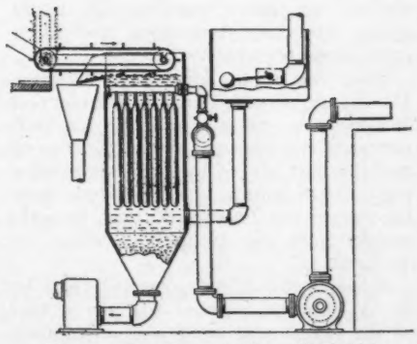
A selective flotation process in which the pulp is agitated with a xanthate and a mineral-frothing agent.

SLOPE OF ROCK. Nos. 1,724,495 and 1,724,720. Aug. 13, 1929. B. McCollum, assignor to McCollum Geological Explorations, Inc., a corporation of Delaware.

Methods for determining the slope of subsurface rock formations by means of transmitting wave energy through the overlying formations.

THICKENER. No. 1,724,436. Aug. 13, 1929. E. J. Sweetland, assignor to Oliver United Filters, Inc., San Francisco, Calif.

A thickener of the suction type.



Illustrating Patent No. 1,724,436

FLOTATION PROCESS. No. 1,721,993. July 23, 1929. W. D. Green, assignor to Combined Metals Reduction Company, Bauer, Utah.

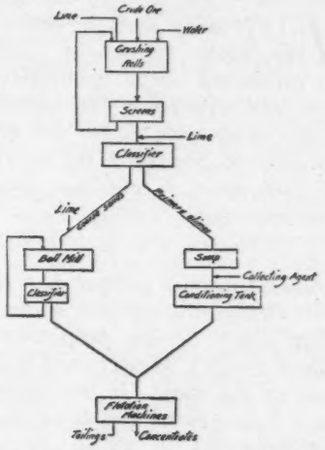
A selective flotation process for the treatment of mixed sulphide ores in the presence of an immunizing sulphite and zinc sulphate, and in the absence of an added free mineral acid.

LEAD REFINING. No. 1,726,346. Aug. 27, 1929. B. W. Gonser and C. W. Haffey, assignors to American Smelting & Refining Company, New York, N. Y.

Antimony is recovered from lead in large percentages by rapidly heating the lead to high temperature and alternately subjecting the bath to oxidizing and reducing conditions. Volatile oxides of antimony are formed and pass off as fume, and non-volatile oxides that form a skim on the surface of the bullion are reduced to a volatile state.

FLOTATION PROCESS. No. 1,722,598. July 30, 1929. J. L. Stevens, Hayden, Ariz.

A flotation process which includes the addition to the ore of a suitable earthy material with which a flotation collecting agent has been mixed.



Illustrating Patent No. 1,722,598

ROD MILL CONTROL. No. 1,726,917. Sept. 3, 1929. R. A. North, Green Bay, Wis.

Means for controlling the feed and discharge of a rod mill.

CONVERTING TIN ORES. No. 1,726,066. Aug. 27, 1929. P. Haedrich and O. Kippe, assignors to Metallgesellschaft Aktiengesellschaft, Frankfort-on-the-Main, Germany.

A method for converting granular tin ores into the form of pieces by means of compressing mixtures of tin ore and highly dispersed tin oxide.

ZINC IN SLAGS. No. 1,727,073. Sept. 3, 1929. H. H. Mayer and R. G. LaMotte, Helena, Mont.

A process for the recovery of zinc from a slag containing a substantial amount of iron. The slag is first subjected to the action of sulphuric acid, sulphates of zinc and iron being formed. The sulphated slag is then heat treated, in the course of which the iron sulphate is decomposed into iron oxide. The zinc is recovered by leaching from the heat-treated product.

Mine Cars

No. 1,727,673. Sept. 10, 1929. C. M. Rogers, assignor to American Car & Foundry Company, New York, N. Y.

A design for a mine car equipped with a dumping door that is actuated by means of a track device.

No. 1,727,689. Sept. 10, 1929. L. Almquist, assignor to American Car & Foundry Company, New York, N. Y.

A design for a mine car equipped with a bottom drop door that is operated and latched at the end of the car.

Rock Drills

Nos. 1,724,619-20. Aug. 13, 1929. J. E. Renfer, assignor to The Cleveland Rock Drill Company, Cleveland, Ohio.

Designs for drill steel retainers.

No. 1,726,334. Aug. 27, 1929. L. C. Bayles, assignor to Ingersoll-Rand Company, Jersey City, N. J.

A valve for rock drills.

NEWS OF THE WEEK

Summary

AFTER sixty years of operation, the Tintic district of Utah is still producing large quantities of silver, lead, and zinc. An important increase in its gold output will result when Eureka Standard, the district's first gold mine, is put into regular production about Nov. 1. Page 598.

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Greene Cananea Copper has completed unwatering of the Cananea-Duluth shaft at its properties in northern Sonora, Mexico, and is now preparing the shaft for development work. New power unit is in operation. Page 600.

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West End Consolidated has ceased operations at its property in the Tonopah district of Nevada, after 25 years. The company's Mabel mine, near Hawthorne, however, will continue to ship ore. Page 601.

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Real del Monte y Pachuca has surrendered its option on the "lost" Mother Lode at Guanajuato, Mexico, after two drill holes showed only junore. Negotiations are now under way for optioning to other interests. Page 597.

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Jack Waite Consolidated has struck a new orebody at its property in the eastern section of the Coeur d'Alene district. After crosscutting through it for 53 ft., driving of the tunnel has been resumed. Page 597.

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Development work at the Aldermac property in the Rouyn district has disclosed several promising bodies of low-grade copper ore. At the Amulet annual meeting, data were presented on the new "F" orebody. Page 597.

* * *

Remodeling of the Achotla plant of Peñoles Mining is nearly complete and the all-brine leaching unit will be ready in December. Operations are now at half capacity. Page 600.

A.I.M.E., Mining Congress, and Northwest Association Meet at Spokane

Sessions in the Northwest Replete With Data on Financial and Technical Aspects of Mining—"Blue-Sky" Legislation and Public Lands Raise Perplexing Problems

G. J. YOUNG

DRIVING three horses in tandem can be considered a feat in horsemanship, but Frank Smith, L. K. Armstrong, and Leon Starmont did as well when they brought together in tandem arrangement the Western division of the American Mining Congress, the Columbia section of the A.I.M.E., and the Northwest Mining Association, at Spokane, Wash., on Sept. 30 to Oct. 5. Three important mining organizations took up their affairs in sequence, delved into important matters, and then left on a two-day trip through the mines, mills, and other metallurgical plants of the great Coeur d'Alene district in Idaho as guests of Bunker Hill & Sullivan, Hecla Mining, and Federal Mining & Smelting. British Columbia, Montana, Idaho, Utah, Washington, Oregon, California and Arizona were well represented geographically. Vocationally, engineers, metallurgists, geologists, professors, operators, and financiers were present.

After the usual addresses of welcome, Dr. E. A. Bryan, former president of Washington State College, concisely narrated the history of the Northwest and the part played by miners and mining. Placer mining and then lode mining were the incentives that brought people into the Columbia valley, he declared.

A paper by E. M. Young, read by E. W. Thorpe, painted the advantages of the investment trust idea in mining. The function of the stock exchange in mine financing was touched on by S. W. Miller, of the Vancouver Stock Exchange. But it fell to Dr. James Hance, Dean of Mines at Oregon State College, to stir the meeting to action. He spoke on "blue-sky" legislation. As former special examiner for the Illinois Corporation Securities Commission, Dr. Hance knew whereof he spoke. All but two states, he declared, have made some provision whereby securities which are offered to the public are carefully scrutinized. In Illinois, he estimated, $620,000,000 had been saved for the public in nine years. "Blue-sky" legislation discourages dishonest and incapable efforts and makes money available for good projects, he declared.

J. D. Galloway, of the British Columbia Department of Mines, stated that in his province all new companies must not only register but must also submit fairly complete reports of what they expect to do. The system of resident engineers affords information about all actual operations, he declared. Prospectuses must be filed with these engineers. The Minister of Mines may criticize statements of fact. Thus mining promotions are allowed freely, but the government exposes dishonest ones. Whenever public criticism has been made, selling stock of the company concerned has immediately ceased.

The fat was in the fire. D. A. Callahan, of Wallace, asked if the Illinois laws could be applied in the Northwest. He thought it would close most Northwestern mines. Dr. Hance replied that the resident of any state has the right to expect a mining engineer's report on the property in which he invests. He emphasized the fact that the Illinois laws were liberal with promotors. Mr. Galloway asked Dr. Hance how many Illinois companies which had received permits had made good. Dr. Hance pointed out that the Illinois commission did not endorse the promotions, but he was unable to give a specific answer. He remarked that only the public could tell, as it was probably wiser than the commission. J. M. Porter, who was thoroughly aroused by the $620,000,000 saving, remarked that, if the public was wiser, he questioned that tremendous figure. He then called for Stewart Campbell, mine inspector of Idaho. Mr. Campbell was on his feet in a second. "So long as a man is honest and is digging a hole," he declared, "let him dig. What is mining but a difference of opinion? Don't pit another man's opinion against his. Let him dig." He endorsed the British Columbia principle of publicity. M. D. Leehey, of Seattle, remarked that though "blue-sky" legislation has its obvious advantages, it

should not limit the right to speculate. Dr. Hance criticized both Mr. Campbell and Mr. Galloway by saying that the publicity system was equivalent to locking the barn door after the horse was gone. Mr. Galloway admitted this was a fair criticism of the British Columbia plan. In this good-natured but intense discussion, opinion ranged over a wide field, from Dr. Francis Thomson's *"caveat emptor"* and "Don't fool yourself into thinking you can protect a fool," to Dr. Hance's idea that a full report by a competent engineer as well as supervision of promotional literature is necessary.

The staff of the British Columbia Department of Mines, which uses the publicity method of discouraging questionable promotions. This method was much discussed at the Spokane meeting. In the first row are Robert Dunn, deputy Minister of Mines; the Hon. W. A. McKenzie, Minister of Mines, and John D. Galloway, Provincial Mineralogist, whose speech at Spokane furnished a good part of the fireworks.

Frank M. Smith opened the Mining Congress meeting on Tuesday. Stanly A. Easton presided at the morning session, with Harry L. Day in the chair in the afternoon. W. Val DeCamp presented Robert E. Tally's address on the Mining Congress and metal mining. Mr. Tally, president of Mining Congress, pointed out that mine taxation is one of the most important problems facing the organization. Fair cash value should enter into mine taxation as well as in other classes of property. Mr. Tally asked for support of President Hoover's proposal to appoint a committee for studying the public lands question. He urged individual operators to back the congress in this question. As for "blue-sky" legislation, he felt that to attempt to remove it would be useless and that education of the public on legitimate mining ventures should receive attention.

G. H. Bailey pointed out that only through the Mining Congress was it possible for the operator to keep in touch with pending legislation. W. W. Bradley, State Mineralogist of California, discussed mineral resources of the Pacific group of states, particularly in non-metallics. Dean Thomson presented G. W. Evans' paper on coal resources of the Northwest. Tremendous tonnages are available, he declared. A. P. Ramstedt, of Hercules Mining, dealt exhaustively with federal and state mine taxation. He favored the net income plan for depletion taxation, as opposed to the gross income plan. It is so simple, he stated, that any taxpayer should be able to compute the allowance.

Mark Woodruff, assistant supervisor of the Columbia Basin Survey, discussed the changing federal land policy. He is in favor of ceding surface rights to the states, but pointed out that forest protection, water supply, and soil erosion are national, not state, problems. J. F. Callbreath, secretary of the congress, also lauded President Hoover's public lands proposal. R. F. Collins believed the Western states should have entire supervision of public lands and Ravenel Macbeth, secretary of the Idaho Mining Association, said that Idaho miners did not favor President Hoover's program. Dean Thomson thought that mineral rights should be included in the transfer. G. H. Bailey, counsel for the congress, and J. M. Porter expressed neutral opinions.

The need for co-operation between mining schools and the mines was the subject of an address by Milnor Roberts. Resulting discussion, however, indicated that such co-operation is now freely given. J. F. McCarthy, of Hecla Mining, approved summer work in the mines for mining students. A description of his company's method of training mining graduates in practical mining was given by Mr. DeCamp, of United Verde. He particularly stressed the need for excellent physical condition as a prerequisite for a mining career. More attention should be paid to fundamentals, he felt, and to training in possible sources of information. Promotion from within the organization is the best system, but at United Verde only 20 per cent of the "bosses" are allowed to be technical graduates. The practical man must be encouraged.

Stanly A. Easton agreed with Mr. DeCamp on the necessity of a sound background of fundamentals. He commented on the high degree of specialization necessary in mining.

Wednesday's Technical Session

Technical sessions crowded the program on Wednesday. C. H. Foreman, of Hecla Mining, described mining methods at that property, using a well-constructed model for demonstration. M. P. Dalton, mill superintendent of Federal Mining & Smelting, presented a detailed paper on operations at the Morning mill. A. W. Fahrenwald complimented the speaker on the good work done at his plant. Ernest Gayford, of Salt Lake City, called attention to the great advance made in selective flotation in the last three years, not only in grade of concentrate but also in recovery. U. E. Brown described mining methods developed at Bunker Hill, of which he is chief engineer. R. W. Lloyd, of Grandview Mines, in the Pend Oreille district, sketched geological conditions there, briefly describing mining conditions at his property.

C. L. Berrien, general superintendent of Anaconda Copper, read A. S. Richardson's paper, on ventilation in the Butte district, in the afternoon. On the Anaconda properties there are now fourteen working shafts, all of which are downcast. Fans are used for upcast ventilating shafts. About 4,300 hp. is required for surface and underground fans at the 29 air shafts. About 3,000,000 cu.ft. per minute is circulated underground, which is about 600 cu.ft. per worker, based on an underground force of 5,000 men.

The importance of the electrolytic zinc plant at Great Falls, Mont., in stimulating zinc concentrate production was brought out in a paper read by R. B. Caples, superintendent of the Great Falls reduction department of Anaconda Copper. Charles Butters congratulated Mr. Caples on Anaconda's progress in electrolytic zinc work. He stated that he had spent $250,000 at Martinez, Calif., in advancing the electrolytic zinc process and had finally arrived at a rate of 1½ tons daily. When considering construction of a plant to produce 3 tons of zinc daily, U. C. Tainton estimated the cost of a plant at $10,000 and asked for $30,000. Mr. Butters said, "Knowing how such estimates result, I doubled the amount and increased it to $70,000. After listening to Mr. Caples I feel that I am going to get that $250,000 back if Anaconda will take my ore. I was 75 in August. I am now entering upon my fourth quarter-century, and I ought to get back my loss by selling zinc concentrate to the Anaconda company." Keen appreciation

for the indomitable spirit of the famous metallurgist was apparent.

Mr. Berrien discussed the development of the Hawkesworth detachable bit in Butte operations. The Emma mine was completely equipped in 1924 with this device, and the Badger State was equipped in 1926. In 1927, the Diamond mine was similarly equipped. Anaconda bought the Hawkesworth Butte plant in June, 1928, to produce detachable steel for all its mines. The Mountain Consolidated, Belmont, Otisco, Elm Orlu, Original, and Steward mines were equipped the same year as well as the Black Rock mine of Butte & Superior. Mountain View was equipped in 1929. The full capacity of the present plant is 140,000 bits a month, with the required shanks. The remaining mines, which use 70,000 bits a month, will be supplied as soon as a new plant, to cost $100,000 and to have a capacity of 225,000 bits monthly and 1,500 new shanks, is completed. Anaconda is satisfied that the detachable bit is a safer, more efficient, and cheaper tool than regular drill steel, Mr. Berrien declared.

The Resolutions

Several resolutions were passed. One concerning federal lands in relation to the states incorporated the following: "We await the decision of those vitally interested in agriculture and animal husbandry as to the advisability of turning over to the states the grazing lands referred to by the President, but we express apprehension of any policy which shall separate the surface from the subsurface rights to public lands." Appointment of a commission to investigate was approved. Another resolution indorsed the percentage of net income method for determining depletion allowances for mines. The congress also reaffirmed its opposition to federal regulation of security sales.

Columbia Section of A.I.M.E. in Technical Session

On Thursday, W. L. Zeigler, chairman of the Columbia section, presided over the technical session of the A.I.M.E. A. F. Beasley, superintendent of the Bunker Hill smelter, described lead refining practice at the plant. It differs from practice of other United States refineries in that the custom, used years ago, of making two skims or crusts, in the desilverizing kettles, has been resumed. "Also, we were the first to adopt the liquation process for silver skims as developed in Australia," Mr. Beasley said. "Both of these ideas were brought to our attention by our good friend, H. S. J. Somerset, in the summer of 1924, while visiting United States metallurgical plants, when he was general superintendent at Port Pirie, South Australia."

The effect of copper sulphate, xanthates, and cyanides in the flotation of sphalerite was presented by A. M. Gaudin, of Butte. Professor Gaudin detected an anomaly in the stand held by many on the behavior of sphalerite. The presence of copper in water explained various erratic results obtained, he decided. Pure sphalerite does not abstract ethyl xanthate from solution and is not floated thereby, he concluded. It reacts very slightly with cyanide solutions; such reaction as occurs forms no coating on the sphalerite, but leads to the solution of some zinc, probably as a complex zinc-cyanide ion. Sphalerite readily acquires from copper-bearing solutions a coating of covellite having a thickness of a few atomic diameters; thereafter the reaction is slow. However, visible coatings of covellite can be prepared in the laboratory. Covellite-plated sphalerite abstracts xanthate from solution and is floated thereby. The covellite coating of sphalerite previously treated with copper sulphate is readily dissolved by cyanide solutions, owing to the formation of the substantially undissociated cuprocyanide ion. Cyanide solutions therefore have a cleansing effect on sphalerite surfaces. Cyanide solutions greatly decrease the floatability of copper-activated sphalerite, bringing it back to the normal floatability of pure sphalerite, which is very slight with xanthate. Natural zinc ores probably contain sphalerite in various stages of activation by copper salts and therefore call for the use of various amounts of cyanide and of copper sulphate in selective flotation. The paper excited favorable discussion among metallurgists present.

W. F. Boericke, of New York, expressed Dr. H. Foster Bain's regret at the unavoidable circumstances that prevented his attendance. Not the least of these was the recent tragic death of Homar Johnson. Mr. Boericke commented on the Seeley W. Mudd memorial fund.

Allen H. Rogers, of New York, said that a committee had been appointed by Dr. Bain to consider some modification of existing mining laws to recognize geophysical prospecting. Mr. Rogers said that a law is proposed which will grant a petitioner a "prospecting permit." This will carry the exclusive right to prospect by geological, geophysical, or other methods any area of the public lands not already located, not exceeding 4 square miles in extent, for two years. The grantee shall file every three months an affidavit of expenditure, not to be less than 25c. an acre for the total area. Such expenditure may be concentrated at one point, however. Expenditures shall be the same as now allowed for assessment work and may, in addition, include expenditures for geological or geophysical surveys. Failure to file the affidavit within 30 days of the three months will cancel the permit. On the expiration of the term, the permit may be extended for a year by payment of $1 an acre. This may be done for two years.

Mr. Rogers pointed out that precedents for allowances on geophysical prospecting work already exist in Canada and some European countries. In Canada, the amount is generally figured at the current wage rate for the men employed. This does not cover the actual expense, as the fee paid the geophysical company is of the order of fees paid to consulting engineers. Usually filing of the geophysical report and maps is required, with the reservation of the right to disallow the expenditure if the work is not performed by a recognized geophysical company. After much discussion, a resolution was approved which called for amplification of the existing laws to permit expenditures for geological and geophysical prospecting. Many refrained from voting because they felt that more discussion of the question was needed.

"Electrical Prospecting by Indirect Methods," by J. Rouvin and A. C. Baldwin, was the final paper of the session. Mr. Baldwin read the paper. Study of subsurface geology, assisted by geophysical methods, was advocated. Additional information can thus be obtained which makes geological studies more significant and which makes more intelligent exploration possible.

To Start Hydraulic Plant in Yuma County, Ariz.

Operation of a 1,000-cu.yd. hydraulic plant at the La Paz properties, in Yuma County, Ariz., will be started within the next two months by Virginia Louise Mining, which recently acquired control of the properties, formerly owned by Los Angeles business men. This plant will be the first unit of a 3,000-cu.yd. installation.

Pull Pumps at Ankerite

Following the recent suspension of operations at the Ankerite Gold mine, Deloro Township, in the Porcupine district of Ontario, pumps are now being pulled and rails removed preparatory to allowing the mine to fill with water. Several rumors have been heard recently regarding merger of Ankerite, Paymaster, and West Dome Lake, but no official statement has been made.

Michigan Tech. Investigates Low-Grade Manganese Ores

THE research department of the Michigan College of Mining and Technology, at Houghton, Mich., which has been engaged for the last six months in manganese and iron-ore beneficiation problems, has devised methods for the treatment of low-grade manganese ores by flotation, gravity concentration, and leaching. Results vary with the ores. In treatment of carbonate and oxide ores, flotation and gravity concentration are the most promising methods. Complex ores—the mangano-siderites—require leaching because of the intricate mixture or fine dissemination of the manganese mineralization. In iron-ore beneficiation, a method has been developed for removal of sulphur. The cost of the operation is too high for commercial use. Further experimentation is planned to devise a practicable process.

Toronto Letter

By Our Special Correspondent for Northern Ontario

Aldermac and Amulet Mines, in Rouyn District, Adding New Bodies to Reserves

TORONTO, ONT., Oct. 5, 1929.—Exploration work at the Aldermac mine, in the Rouyn district of Quebec, is showing large bodies of low-grade copper ore. This property is controlled by Noranda Mines. In No. 3 orebody, 300,000 tons of 3 per cent copper ore has been proved. On the 500 level, No. 4 orebody has been opened up and shows a maximum width of 140 ft. The ore is massive pyrite, carrying about 2 per cent copper. About 3,000 tons of ore to each foot of depth is indicated. A similar orebody, known as No. 6, has been opened up on the 1,125 level. A width of 185 ft. has been indicated, with estimates of tonnage placed at 4,000 tons for each foot of depth.

AT THE annual meeting of Amulet Mines, also operating in the Rouyn district, a report of diamond drilling brought up to Sept. 28 was presented. The meeting was held in Montreal on Sept. 30. "F" orebody was the most important discovery made this year. The first body is officially estimated to contain 75,000 tons having a gross value of $34.74 per ton. The next body is estimated to contain 35,000 tons of $26 ore and the lowest body 35,000 tons of ore running about $13 per ton. In these estimates copper was taken at 18c. and zinc at 6½c. This indicates $4,000,000 of new ore developed in the year, and, added to the previous estimate, a total of ore having a gross value of $15,000,000. The indicated tonnage and grade of the three orebodies in the "F" deposit is 145,000 tons averaging 4.11 per cent copper, 8.9 per cent zinc, 58c. in gold, and 1¼ oz. of silver to the ton. These estimates do not take into account an important orebody which has been indicated under the diabase sill.

Ground has been cleared for the concentrator and forms for the foundations are being erected. Practically all the machinery has been ordered for delivery in the latter part of December. The concentrator is expected to be in operation next spring. The railroad branch line now under construction should be completed by Dec. 15.

Lake Geneva property, west of Sudbury, in which the Towagmac Exploration has a 70 per cent interest, is now stated to be ready for a mill. A 50-ton unit will be installed. Development has indicated about 70,000 tons of ore above the 235 level. Most of this ore is in one shoot, which gives an average of 14 per cent zinc and 6 per cent lead, over a width of 4.7 ft.

Shareholders of Moss Mines, in northwestern Ontario, have been advised that the company has decided to install a 100-ton mill. To finance construction and to provide working capital, 900,000 shares of treasury stock will be issued at 50c. a share. Of this amount directors and some of the larger shareholders have already agreed to take up 300,000 shares. New stock will be issued to shareholders in the proportion of one share of new stock for each share held.

On the 375 or bottom level an increase in both width and grade of ore is reported. About 274 ft. of ore has been opened up on this level, with an average width of 2½ ft.

Mexico City Letter

BY W. L. VAIL
Special Correspondent

Real del Monte Ceases Its Development Work on the Guanajuato Mother Lode

MEXICO CITY, Oct. 6, 1929.—Diamond drilling on the Mother Lode, in the Guanajuato district, which was started last winter by Real del Monte y Pachuca, Mexican subsidiary of U. S. Smelting, Refining & Mining, has been abandoned and the company has surrendered its option on the lease from Messrs. Chippendale and Murray. Two holes were put down about 2,100 ft. from the famous fault, but only junore was encountered. The owners are now negotiating with other operators for further exploration work on this territory, about midway between the Real del Monte drillings and the original work done by Peñoles Mining, American Metal subsidiary. Existence of a continuation of the "lost" lode has been definitely established, but evidently the grade is not commercial.

REPORTS state that Lucky Tiger-Combination Gold, operating the El Tigre mine, in the Moctezuma district of Sonora, will cut down its labor force. This company is one of the most important producers of silver and gold in the state, but exhaustion of ore reserves, as outlined in the annual report, makes necessary reducing the scale of operations. About 125 men will be dismissed now, and more will probably be discharged later.

Old mining properties on the west coast of Mexico, particularly in Nayarit and Sinaloa, are being reopened and refinanced. United Eastern is reported to be doing considerable development work at its properties near Copala. Several mines in this district are arranging for airplane service to furnish transportation, Sinking of a shaft is now under way at the Morada mine, in Nayarit, which has been taken over by Mexican Premier. This company is shipping lead-silver concentrate from its mill at the San Jose mine to the A. S. & R. smelter at Monterey.

Errington Spur Construction Ahead of Schedule

CONSTRUCTION of the Canadian Pacific Railway's new branch line from Chelmsford to the Errington mine of Treadwell Yukon, in the Sudbury district, is proceeding so rapidly that officials state that trains will probably be running over the line by Nov. 1, a month ahead of schedule. The branch will be 6 miles long. When completed it will parallel the Errington ore zone, past Nos. 2 and 3 shafts, and will connect with the concentrator at No. 1 shaft. The branch was built to pass close to the probable site of any metallurgical plants which may be built.

The pilot mill is handling from 300 to 400 tons daily and making almost sufficient revenue to pay for operations. Treadwell Yukon complex lead-zinc ore affords a difficult metallurgical problem. Once it is solved in pilot-plant operations, construction of a much larger plant will probably be undertaken.

War Eagle Sells Holdings

Properties of War Eagle Consolidated Mining, of Philadelphia, including the Sinker tunnel and the Stormy Hill group, at Silver City, Owyhee County, Idaho, have been taken under option by a New York syndicate represented by Kirby Thomas.

Jack Waite Resumes Driving Idaho Tunnel

DRIVING of the tunnel on the Idaho side of the Jack Waite Consolidated holdings, in the eastern part of the Coeur d'Alene district, has been resumed, following the discovery of a new orebody in a crosscut. The crosscut has been driven 53 ft., of which 10 ft. was in junore and the remainder in mill-grade ore.

Although the full width of the new orebody had not yet been ascertained, crosscutting was discontinued, as it was impracticable to complete the crosscut to the footwall without laying track. The tunnel had evidently been following the hanging wall of the orebody up to the time of the discovery. Its course has now been changed to a gradual swing toward the footwall.

Chalk Mountain to Resume

Operations of the Chalk Mountain Silver-Lead mill, 45 miles east of Fallon, Nev., were scheduled to be resumed this week, according to E. M. Dawes, who is in charge. The mill, which was constructed recently, has been closed down for remodeling of the flow sheet. Hereafter the mill will attempt to recover silver and lead contents of the ore only, although originally designed to recover vanadium and other rare metals.

Property of the Tintic Standard Mining Company at Dividend, Utah. No. 1 shaft at extreme left; No. 2 shaft and ore bins in the center, and townsite in the foreground.

Tintic District Still Going Strong After Sixty Years of Production

East Side Has Superseded the Western Section as Chief Producing Area—North Lily and Eureka Standard Are the Two Most Important and Significant Developments in the Camp

GAIL MARTIN,
Special Utah Correspondent

SIXTY YEARS ago two lone prospectors camped on the rolling desert waste which is now the Tintic mining district of Utah. While gathering firewood, one of them noticed the glint of the setting sun's rays on an outcrop. Investigation showed high-grade ore. That night, a claim was located. Steve Moore, the original locator, called it the Sunbeam, to give the sun full credit for leading him to what appeared to be a bonanza. And a bonanza it was.

To date the Tintic district has produced $320,000,000 in lead, silver, zinc, copper, and gold. It has paid about $51,000,000 in dividends. After six decades of steady production, citizens of Eureka, on Aug. 28, held a Silver Jubilee, celebrating the sixtieth anniversary of the first discovery. Some of the old mines have, of course, closed down during those sixty years, but new mines have been found. Today the eastern section, to which attention was first attracted by the Tintic Standard discovery in 1917, has superseded the western area as the center of production and development work.

Acquisition of control of the Knight Investment holdings by North Lily Mining, a subsidiary of International Smelting, which in turn is the Utah subsidiary of Anaconda Copper, has been the outstanding event of 1929. Expenditure of $300,000 in three years for development work is assured. Tentative plans provide for sinking the Big Hill three-compartment shaft from 600 to 1,500 ft., the equivalent of the 1,200 level at North Lily, for exploration of the Ophir sedimentaries. Similar exploration work will be undertaken in the Twentieth Century property, either from a near-by shaft or by continuing the Eureka Bullion drift on the 1,200 level into the property.

In the older part of the camp, North Lily Knight will develop the Empire Mines group, which has been the center of intensive exploration in the upper limestone formation. Development of the Ophir sedimentary formation will be carried on through the lower Mammoth shaft.

Another important transfer of property in this district resulted from the acquisition of Bingham Mines by U. S. Smelting, Refining & Mining. Both the Eagle & Blue Bell and Victoria mines, which were included in the transfer, are producing.

Development in the North Lily mine centers about four separate projects. Perhaps the most interesting is the development of the main orebody on the 700 level at the 1,200 level. In two raises, 150 ft. apart, from the 1,200 level, substantial oreshoots have been struck. The area has possibilities of producing from 60,000 to 100,000 tons of ore, averaging 20 per cent lead, 20 per cent zinc, and some silver. This ore is easily amenable to flotation, and remarkable recoveries are being made from it at the Tooele flotation plant of International Smelting.

Another important part of the development program is the sinking of the four-compartment shaft to the Cambrian quartzite formation. Drifting is being undertaken on the 1,350 level to cut the extension of the Eureka Lilly ore zone, from which Chief Consolidated has been producing. Shaft sinking has just struck the Cambrian quartzite at 1,650 ft., which corresponds to the 1,350 level of the Tintic Standard. Ore has been struck in two places near the shaft on the 1,600 level.

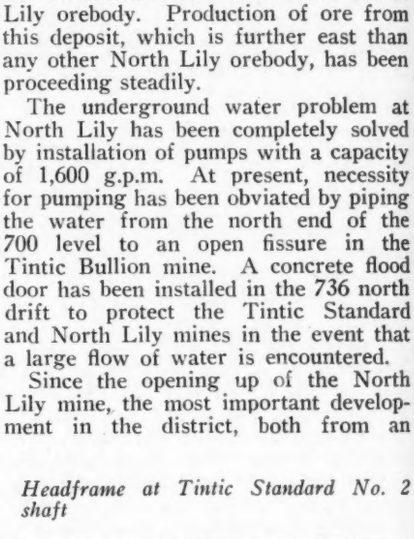
In two drifts in the north end of the property on the 700 level, development work is being undertaken on new ground. Surface bleaching and alteration indicate that a block of Ophir limestone has been downfaulted into the Cambrian quartzite below the surface rhyolite flow. Diamond drilling has checked this supposition. In the Tintic Bullion property of Chief Consolidated, adjoining this area on the southwest, a body of lead-zinc sulphide ore is being developed in a crushed quartzite formation. A winze sunk 45 ft. on this orebody has been continuously in ore.

On the North Lily 700 level, the continuation of the Eureka Lilly deposit is also being opened up. It has no connection with the main North Lily orebody. Production of ore from this deposit, which is further east than any other North Lily orebody, has been proceeding steadily.

The underground water problem at North Lily has been completely solved by installation of pumps with a capacity of 1,600 g.p.m. At present, necessity for pumping has been obviated by piping the water from the north end of the 700 level to an open fissure in the Tintic Bullion mine. A concrete flood door has been installed in the 736 north drift to protect the Tintic Standard and North Lily mines in the event that a large flow of water is encountered.

Since the opening up of the North Lily mine, the most important development in the district, both from an

Headframe at Tintic Standard No. 2 shaft



Typical Tintic prospect shaft—the Tintic Giant

economic and geologic standpoint, has been the making of the Eureka Standard mine by Tintic Standard Mining. This property is a mile south of the Tintic Standard mine. It is the first mine to be found in the quartzite formation in the Tintic district and it is the district's first large gold mine.

Reserves sufficiently large to justify the construction of an 85-ft. steel headframe have been found at the Eureka Standard. An Ingersoll-Rand compressor with a capacity of 2,750 cu.ft. per minute is being installed. A railroad spur a mile long is being built from the Dividend station of the D. & R. G. W. railroad. The present production of about 70 tons daily is being hauled underground through the 900 level to the Tintic Standard No. 2 shaft at Dividend. Within 30 days, the new headframe will probably be completed and operations through the shaft started. A Wellman-Seaver-Morgan hoist will be used. At this mine the ore occurs in a fissure in the quartzite. Gold is associated with pyrite, quartz, and barite.

The Tintic Standard mine has had a prosperous year. For the first nine months of 1929, dividend requirements have been more than met. Production is coming from every level in the mine from the 700 down to the 1,350. At the Iron Blossom mine, controlled by the same company, output is averaging 50 tons daily from the 400, 500, and 700 levels. A connection was made this summer between the Iron Blossom bottom, or 2,180 level, and the Colorado 1,914 level. A distance of 1½ miles separates these two properties. Work in the Colorado, also owned by Tintic Standard, is confined to raising and drifting on mineralization in the Noah limestone bed of the Eagle & Blue Bell series.

Development in the Iron King mine of Tintic Standard centers on two points along the intersection of the Iron King fault with the Eureka Lilly fissure system on the 1,450 and 1,550 levels. South of the fault, the company is exploring the Ophir limestone formations and north of the fault, the Cambrian quartzite. Under the management of the late Col. C. E. Loose, development of the quartzite showed some rich ore, but the Ophir sedimentaries were not prospected. Two Worthington pumps, with a capacity of 200 g.p.m. each against a 1,500-ft. head, have been installed. A Byron Jackson deep-well type pump lifts the water from 1,550 to 1,450 ft.

Seven mines are being operated by Chief Consolidated, including the Chief No. 1, Plutus, Eureka Hill, Eureka Lilly, Eureka Bullion, and Tintic Bullion. Production is maintained at about 30 carloads of ore weekly. Some excellent results are being obtained at the Chief Consolidated mill in the flotation of oxidized lead ores. About 140 tons is being treated daily at a fair profit. Minerals Separation equipment is used.

Development of Chief Consolidated properties on the east side of the district has been fairly successful. A fair tonnage of gold and silver-lead ore is being shipped from Eureka Lilly, adjoining North Lily. The outcome of work in the Tintic Bullion mine, where, it is believed, a new ore zone paralleling that of Tintic Standard, Eureka Lilly, and North Lily has been discovered 1,000 ft. to the west, is most eagerly awaited. This zone may traverse the whole length of the Tintic Bullion and north into North Lily, where drifts on the 700 level are searching for its continuation. In Eureka Bullion, on the 1,200 level, ore exposures indicate that the company is on the track of the North Lily ore zone. This may persist through Eureka Bullion into the Big Hill mine of North Lily Knight.

At the northern end of the district, important work is being conducted by North Standard, Central Standard, and Lehi Tintic. At North Standard, gas and other geologic conditions similar to those in the Tintic Standard prevail. The Central Standard is prospecting the quartzite. Lehi Tintic has completed sinking its shaft to the 1,100 level to prospect the Opex limestone in accordance with indications of a geophysical survey just finished by Carl Chilson.

Silver Shield Mining & Milling is sinking its shaft from the 900 to the 1,500 level on its Independence group, driving a tunnel in its Flying Dutchman and Copper Jack properties in West Tintic, and doing surface work on two other groups.

Little May Mining, which has a lease on the South Standard mine of Tintic Standard Mining, is driving a tunnel about a mile south of the Eureka Standard to prove a condition similar to that existing in the Eureka Standard.

Under a co-operative agreement with International Smelting, Standard Lily Extension Mines is sinking the East Tintic Coalition shaft of the former company. This shaft, now down 570 ft., will be sunk to the 1,800 level and drifting will be done on several horizons. Eventually, a depth of 2,800 ft. will probably be attained to develop the Ophir limestones. By this method of operation, International Smelting will secure an entry to its East Tintic Coalition group and Standard Lily Extension to its adjoining Addie and other claims.

New Pecos Orebody Proved for About 750 Ft.

DEVELOPMENT work on the new lens of lead-zinc ore discovered below 800 ft. at the Pecos mine of American Metal, near Santa Fe, N. M., has disclosed a vertical length of between 700 and 800 ft., according to supplementary information received since publication of the article in last week's *E.&M.J.* It has already been proved to extend to a depth of at least 1,100 ft. This new orebody is known as the "Cucaracha," and it occurs in the Evangeline shear zone, which is part of the general shear zone in which the Pecos orebodies are found.

Three diamond-drill holes in the Katydid shear zone indicate that the Katydid orebody pinches out somewhere between 600 and 800 ft. A drill hole, put down from the 800 level, however, indicates ore at about 900 ft. in this shear zone.

Snyder Interests Reopening Nicholia Mine

A new company, Lead Mountain Mining, has been organized by the Snyder interests, of Salt Lake City, and J. E. Jones, West Virginia coal operator, to reopen the old Nicholio lead mine, 17 miles southeast of Gilmore, Lemhi County, Idaho. This property is reported to have produced 300,000 oz. of silver and $1,000,000 in lead in the early 'eighties. The new company, under the direction of G. W. Snyder, has started sinking a shaft to explore for the faulted segment of the limestone replacement orebody.

Complete Unwatering of Cananea-Duluth Shaft

UNWATERING of the Cananea-Duluth shaft by Greene Cananea Copper, in northern Sonora, Mexico, has been completed. Concreting of the shaft is now going on down to the No. 6 level. Below that point retimbering is being done. This mine has been idle since the destruction of the surface plant by fire in 1923. At present work centers about shaft work and the surface plant, but lateral development will be started soon.

New equipment will be installed, including a 5,000-cu.ft. Sullivan twin-angle duplex compressor; a Nordberg double-drum, single-reduction, electric hoist; and 4-ton capacity skips. This equipment is designed for hoisting from a depth of 1,000 ft. at a speed of 1,000 ft. per minute. The hoist is a duplicate of the two hoists in use at the Colorado mine, and is driven by a 2,200-volt a.-c. motor. A new power line is being built to the Cananea Duluth from Cananea.

The new high-pressure boilers have been in operation since the beginning of August as well as the new 6,000-kw. turbine. Remodeling of the concentrator has not yet been completed. Four different kinds of copper ore are treated in the mill, so the problem is not simple.

In addition to the mill work, 1,000-ton capacity concrete and steel coarse-ore bins will be built and the crushing plant will be enlarged. At present this consists of a No. 8 Allis-Chalmers gyratory crusher and two 48-in. Symons vertical disk crushers, all in one unit. The new crushing plant will consist of two units, each containing a No. 8 Allis-Chalmers gyratory, followed by a 7-ft. Symons cone crusher. The narrow-gage railroad which connects the mines with the rest of the plant will run over the new bins. A new conveyor belt and housing will be installed under them to carry the ore to the crushing plant, and a new sampling plant will also be built.

Production of Greene Cananea has continued at an even rate since the 10 per cent decrease was put into effect last spring. The Colorada mine is now in regular production and is furnishing the bulk of the output.

Remodeled Achotla Plant to Start in December

Operation of the remodeled Achotla plant of Peñoles Mining, in Guerrero, Mexico, will probably start some time in December. This plant, which has a capacity of 300 tons of silver-gold ore daily, is being changed to all-brine leaching methods from cyanidation. No increase in capacity will result from the change. At present only 5,000 tons a month is being handled in the cyanide unit, awaiting the completion of the salt recovery plant. Recoveries with the present system have shown some improvement.

Cresson Cuts High-Grade Ore

High-grade gold ore has been found in new territory outside the contact of the Cresson crater on the No. 14 level of the Cresson Consolidated property, in the Cripple Creek district of Colorado. A drift shows the oreshoot to be about 8 ft. wide. Another strike has been made on the No. 9 level, along the contact. This is of lower grade than the other find. A carload of ore from this body has been shipped to the Golden Cycle mill, at Colorado Springs.

Tungsten Corporation to Increase Mill Capacity

Milling capacity at the Round Valley plant of the Tungsten Corporation of America will be increased from 125 to 500 tons daily. The company recently acquired the property, near Bishop, Calif., from Round Valley Tungsten, which operated it during the war. Tungsten Corporation ran the mill for two months to test the ore and the mill recovery.

Lake City Spur Ready to Resume Operation

The Denver & Rio Grande Western railroad has repaired its spur line from Lake City to Sapinero, Colo., and the road was scheduled to resume service on Oct. 10. A cloudburst in August washed out sections of this line, which serves the Lake City mining district. For some time it was not known whether the spur would be repaired. Empire Chief Mining, which is operating its new 200-ton flotation plant, has shipments of concentrate ready to send out. Ute & Ulay, owned by M. B. Burk (who was erroneously reported in *E.&M.J.* of Sept. 28 to be connected with Empire Chief), is constructing a new mill in the district. It will be completed later in the autumn.

Drilling Starts at Mumbwa

Drilling has now been started on a property in the Mumbwa area of Loangwa Concessions, in Northern Rhodesia, and several claims have been pegged in the sector between Mweru and Tanganyika. Excellent mineral prospects are said to exist in the Rhodesia Minerals Concession, in regard to which the Loangwa Concessions has recently entered into an agreement for extended development.

Siscoe to Sink New Shaft

Recent diamond-drilling results at the Siscoe Gold property, in northwestern Quebec, have justified sinking a new three-compartment shaft at a central point on the vein system. Diesel-electric power equipment, a hoist, and additional fuel-oil storage tanks will be installed to aid in this work.

Production from the old incline shaft continues on a basis of 100 tons daily. Southwestern Engineering is now preparing estimates for increasing mill capacity from 100 to 500 tons daily, as soon as navigation opens in the spring.

Another United Verde Crew Makes Safety Record

THE group of miners shown in the accompanying illustration have completed a full year's employment at the United Verde Copper mine, at Jerome, Ariz., without a single lost-time accident. This is equivalent to 12,200 man-shifts. On June 29, 1929, *Engineering and Mining Journal* printed a picture of a crew of United Verde men who had worked 10,095 man-shifts without an accident. Jack Eddy, standing at the extreme right of the lowest row, is the shift boss.

These men are part of a mine division group of 175 men, under the supervision of Walter Mutz, division mine foreman, who have worked 100 consecutive days, or 17,500 man-shifts, without a lost-time accident. Both groups have established new safety records at the United Verde, according to Oscar A. Glaeser, safety engineer.

In spite of declining silver markets, the interesting little pile in the illustration above is worth about $500,000. It is a shipment of 949 silver bars, with an aggregate weight of 1,000,000 oz., recently made from the Monterey refinery of the Compañia Minera de Peñoles, a subsidiary of American Metal. It was sent to London via Tampico on Sept. 21, and is one of the largest shipments ever made from the Monterey plant.

Alaska Compensation Act Excites Opposition

THE new Labor Compensation Act of Alaska, which went into effect April 16, 1929, has excited opposition to some of its conditions. Arthur C. Moa, of Hyder, Alaska, expresses the opinion that this law as it now stands makes it almost impossible for any but the strongest companies to operate in Alaska, as insurance companies will not carry any mining risk under the act. Most of the pioneering in the various industries is carried on by small companies. The act is also said to place the mining industry of Alaska at a disadvantage in competing with British Columbia for development financing, as the mining laws and compensation act of British Columbia encourage the mining industry.

Among the objectional features, the Hyder Chamber of Commerce lists the following:

The Compensation Act now in force in Alaska provides that married alien emloyees' families can obtain up to 60 per cent and the relatives of an unmarried alien employee 50 per cent of any amount obtainable by the relatives of an unmarried citizen of the United States. A discrimination against married and unmarried employees who are citizens of the United States, in favor of alien employees, is an actual and necessary result of these schedules.

Workingmen and employees of all kinds, as well as corporations and business men, are adversely affected by the act, which takes no note of the prosperity or lack of prosperity of such corporations or business men. No industrial insurance is available in Alaska, whereby an employer can protect himself against these losses.

As a result of this and previous similar legislation there has been an actual withdrawal of capital from Alaska, or a refusal of capital to engage in gainful enterprises therein—particularly in mining, on which the territory so largely depends.

The Hyder Chamber of Commerce urges the officials of the territory to study the British Columbia, Oregon, and Washington compensation acts, with a view to the immediate preparation of a compensation act that will invite, rather than hinder, the entrance of capital into this territory. The Hyder mining district, as a particular instance, the Chamber declares, has been held back by bad laws, inimical alike to capital and a proper exploitation. The Canadians across the border, on the other hand, are prosperous, aided as they are in every way by wise and stable laws, beneficial to the workers and fair in their treatment of capital. Not the least part of their excellence is their stability. One of the hardest things in British Columbia is to change a basic law—which results in the security of labor and capital alike.

West End Consolidated Stops Tonopah Operations

AFTER operating for 25 years and paying $1,250,000 in dividends, the West End Consolidated mine, at Tonopah, Nev., has canceled all leases and suspended operations. The present low price of silver does not permit profitable operation at present. Resumption of operations will depend as much on the result of development work in the adjoining Tonopah Extension mine as on the price of silver, although a considerable tonnage of junore remains in the mine. Tonopah Extension has discovered new ore recently not far from West End ground. This decision does not affect the company's Mabel mine, near Hawthorne, Nev., which will continue operations.

About two years ago there was a contest for control between "Borax" Smith, who controlled the company, and minority stockholders. The Smith faction won, but later declared dividends, distributing stock in the West End Chemical Company and Searles Lake Borax Company. Mr. Smith then resigned and turned control over to Fred C. Ninnis and H. D. Budelman, long-time employees, as a compromise with minority stockholders.

Empire Zinc Expects to Start Mill in December

OPERATION of the new 500-ton flotation mill, built by Empire Zinc, a subsidiary of New Jersey Zinc, at Belden, Colo., will probably start in December in spite of the fact that recent heavy rains have slowed up the work. Because Eagle River canyon is too narrow to permit construction of a large plant, the Empire mill is being built entirely underground. In addition, partial prevention of the slight oxidation which results from exposure of the ore to air is expected to make flotation treatment easier. The cost of the new plant has been estimated at $1,500,000.

The mill is about 100 ft. below the Newhouse tunnel and will extend along the face of Battle Mountain for 400 ft., about 150 ft. from the surface. Ore pockets to hold ore from the Newhouse tunnel will be constructed above the mill. Electric power is being supplied by the Public Service Company of Colorado. A 3-mile tailing flume has been built to Aster City to prevent pollution of the Eagle River.

Bonds Hamilton Mine, Near Armstead, Mont.

Louis Hoffman has taken a bond and lease on the Hamilton mine, at Chinatown, near Armstead, Mont. The property was formerly worked by Standard Silver-Lead. Since acquiring the property, Mr. Hoffman has shipped several carloads of silver-lead ore to the Midvale plant of U. S. Smelting, Refining & Mining, in Utah.

MARKET AND FINANCIAL NEWS

London Financial News

By G. H. GREEN
Special London Correspondent

LONDON, Sept. 24, 1929.—The collapse of the Hatry group of companies and the crisis which the disturbance has engendered have had far-reaching effects on nearly all markets, and although the first nervousness is now wearing off, the effects of forced selling are still visible in several directions. The mining market has suffered with others. In many instances quotations have been forced down to unjustifiably low levels, and "shorts" have been busy, but shrewd observers predict an early recovery in this particular market.

Northern Rhodesian copper shares continue to attract considerable attention, and in this connection rumors are becoming more persistent as to a proposed big merger. An even closer association than already exists of the Chester Beatty and Sir Edmund Davis interests is contemplated, according to report, in the formation of a Rhodesian Copper Trust with a capital of £3,000,000 or £4,000,000 in 5s. shares. The Bwana M'Kubwa and Loangwa are mentioned in connection with the scheme, and the former, after making losses for years, is now, owing to improved metallurgical practice and the remodeling of the plant, working at a profit on an average output of 600 short tons of copper per month.

Onverwacht Platinum's annual report, recently issued, makes poor reading. The company was launched in 1926, and great expectations were formed as to its potentialities. These have not been realized, and although the company has paid, in all, dividends amounting to 30 per cent, the mine is within sight of exhaustion and stoping operations have practically ceased. About 4,000 tons of surface ore remains to be treated, and the price of the mineral has fallen from about £25 per ounce when the company started operations, to the more or less nominal figure of £10 per ounce, at which price the Russian government could probably supply any reasonable demand.

Hugh F. Marriott is optimistic regarding the outlook for the Panama Corporation, the latest developments being encouraging, particularly on the Hatillos property. The No. 2 tunnel is now in 1,443 ft., the lode being from 4 ft. to 5 ft. in width and heavily mineralized throughout. This lode is payable on its lead and zinc contents alone, and the gold, which I understand averages at least 0.50 oz. per ton and may probably be double that amount, is so much extra profit. The ore is amenable to simple treatment, and as this particular mine is one of over a dozen others with similar formation in the same district, the possibilities are regarded as very great. Examination and opening up of the corporation's large area will no doubt take time, but, at any rate, it is being energetically taken in hand under the most favorable auspices.

Operations on the Wiluna Gold Mine, Western Australia, were mainly confined in the last year to the development and opening up of the orebodies on the southern part of the property. H. E. Vail, consulting engineer, is satisfied as to the ore-reserve position and the continuity of orebodies at depth. A plant to treat 40,000 tons of ore monthly has been designed, and the government railway to the property should be completed before the end of the year. Owing to metallurgical research, costs are expected to be low, and 14s. 6d. per ton profit on 40s. ore is looked for.

Broken Hill Proprietary Earns Profit of £332,670

NET profit for the year ended May 31, 1929, of the Broken Hill Proprietary Company, Ltd., which owns a lead-zinc mine at the Barrier, New South Wales; iron-stone quarries in South Australia, and iron and steel works at Newcastle, was £332,670, or £64,000 more than was necessary for the dividend of 10 per cent. Although the profit was 12.4 per cent of the capital of £2,687,708, it was only 5.6 per cent of the shareholders' funds of about £6,000,000.

Six per cent debentures to the value of £54,300 will be redeemed on Dec. 31 next. The profit on working account was £795,952, compared with £611,702 in 1927-8, and income from interest and dividends was £142,901, compared with £171,831. Reductions of £17,858 in debenture interest, £24,270 in income tax, and £10,000 in the contribution to the provident fund helped the management to show a higher net profit.

London Tin Syndicate Gets Nigerian Producer

STOCKHOLDERS of the Northern Nigeria Tin Mines, Ltd., one of the most important producing units in the region where the company is operating, have been informed that an agreement had been concluded for amalgamation of the company with the London Tin Syndicate by interchange of shares.

Through acquisition of the Nigerian property the London Tin Syndicate will become the largest alluvial producer of tin within the British Empire. Earlier this year the London Tin Syndicate acquired another Nigerian property, the Ropp Tin, Ltd. The syndicate and its associates will gradually consolidate and bring under single direction and management all the principal units in Nigeria. At present over 65 per cent of the total Nigerian output is under control of the Anglo-Oriental group of which the London Tin Syndicate is a part.

Mining Expenditures in Idaho Show Gain for 1928

MINING expenditures in Idaho in 1928 by the non-producing development companies, the producing non-dividend paying companies, and assessment work on mining claims and for location work on new mining claims amounted to $10,241,738, compared with $10,066,465 in 1927, an increase of $175,273, according to Ravenel Macbeth, secretary of the Idaho Mining Association. None of the companies responsible for these expenditures paid a dividend in 1928.

Mining Expenditures in Idaho in 1928

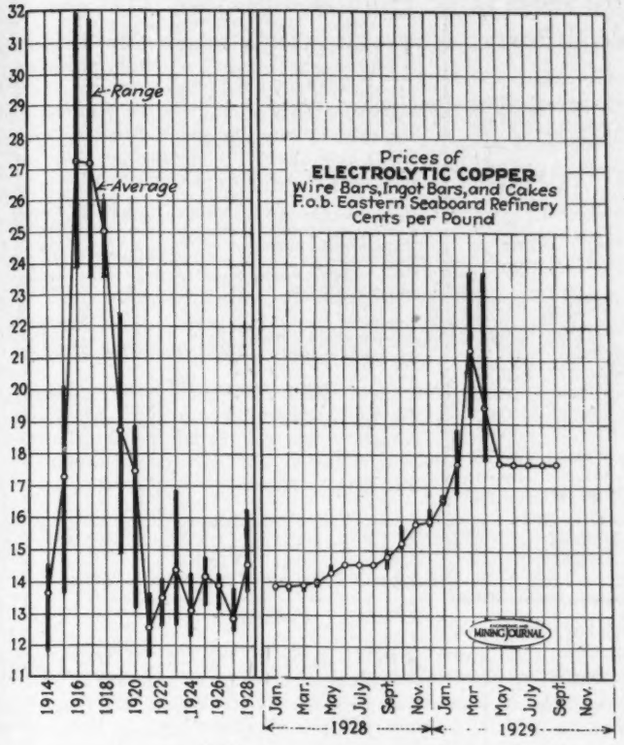
Non-producing development companies:	
Labor	$2,258,942
Supplies	957,286
Mine equipment	286,190
Mill equipment	74,280
Total	$3,576,698
Producing non-dividend paying companies:	
Labor	$2,735,500
Supplies	2,325,820
Mine equipment	159,990
Mill equipment	158,340
Ore transportation	361,250
Total	$5,740,900
Assessment work on 8,585 mining claims at $100 per claim:	
Labor	$643,900
Supplies	214,600
Total	$858,500
Location work on 2,188 mining claims at $30 per claim:	
Labor	$49,230
Supplies	16,410
Total	$65,640
Total 1928 expenditures	$10,241,738

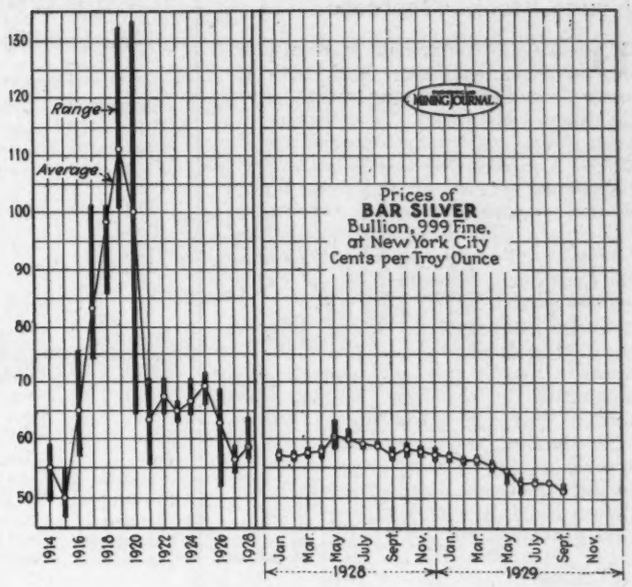
Men employed by 709 companies totaled 3,171.

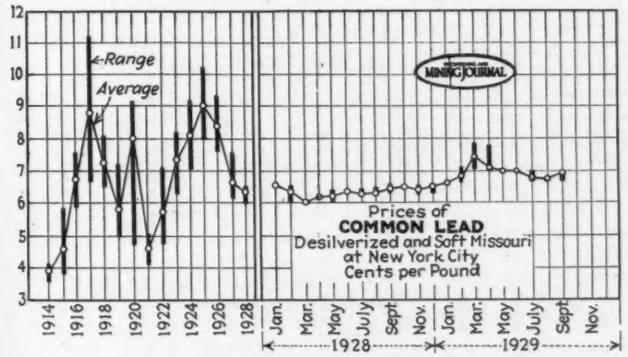
Mining expenditures from 1923 to 1928, inclusive, amounted to $53,731,647. None of the companies responsible for the expenditure of this sum has paid a dividend in the year in which it was listed.

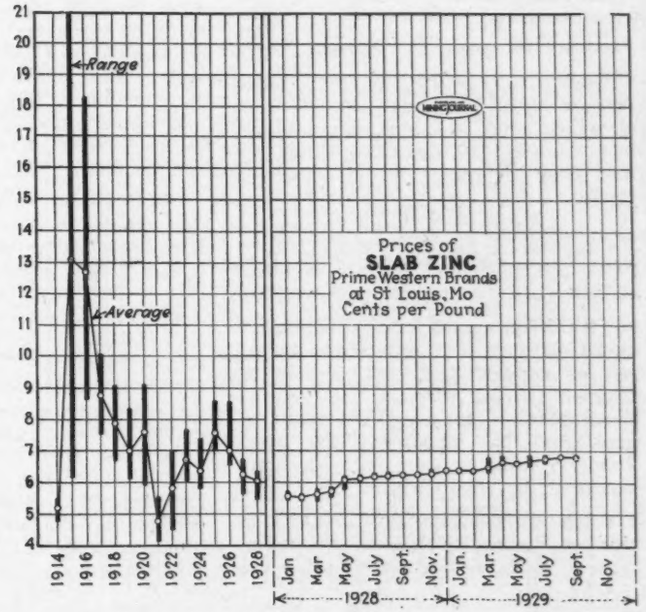
SELAYANG TIN DREDGING, LTD, operating in the Federated Malay States, earned a net profit of £11,090 for the year ended Dec. 31, 1928, the company's first full year of production.

Metal Price Curves

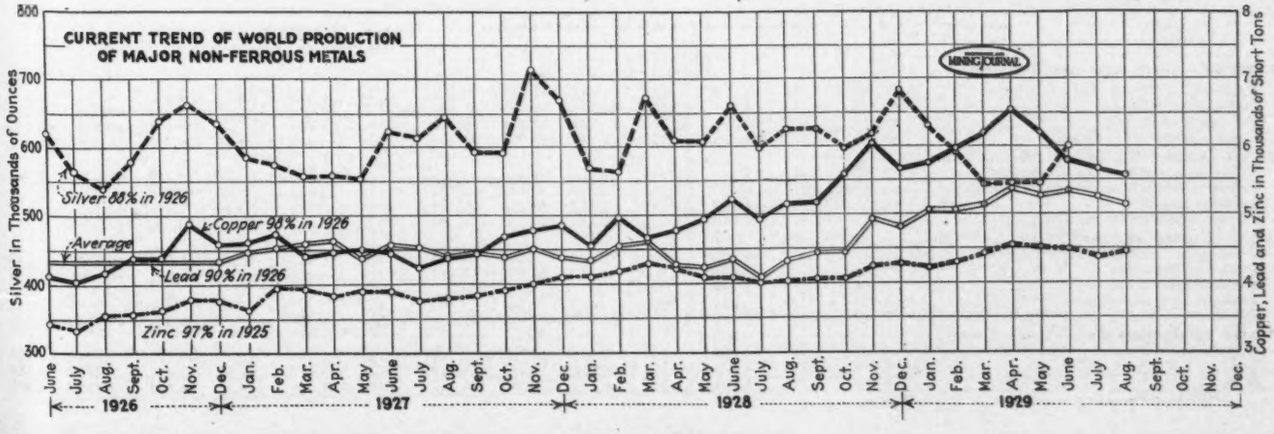








THE CURVES below are not to be considered as permanent records of production. They show merely the current trend in terms of daily output according to the latest estimates of the American Bureau of Metal Statistics. The figures represent production from countries that produce approximately 98 per cent of the world's copper, 97 per cent of the zinc, 90 per cent of the lead, and 88 per cent of the silver. The figures for lead on the new basis are not available for the individual months of 1926, and accordingly the horizontal line showing the monthly average reduced to a daily rate is shown. Delay in receipt of statistics from Mexico accounts for the failure of the silver curve to be up to date.



Arsenic Demand Improves; Crude Stocks Decrease

DEMAND for arsenic was quite active in September, with both insecticide and glass manufacturers taking on liberal quantities. Earlier in the year there was some irregularity in prices, but with the increased activity, occasioned largely by the reduction in stocks of calcium arsenate, the market has taken on a firmer appearance. Virtually all of the business booked in the last month or so has been placed at 4c. per pound.

Latest statistics, covering August, show that production of crude in the United States fell off considerably, amounting to 887 tons, against 1,444 tons in July, and 2,452 tons in June.

Production, deliveries and stocks of arsenic in the United States, according to the American Bureau of Metal Statistics, for July and August of the current year, follow:

	July	August
Crude:		
Production	1,444	887
Deliveries to refiners	1,071	956
Deliveries to consumers	536	53
Stock at end of month	1,998	1,876
Refined, 99 per cent:		
Production	812	857
Stock at end of month	3,305	3,414

Imports of white arsenic during August, 1929, amounted to 788 tons, of which total 114 tons were shipped from Canada, 610 tons from Mexico, 49 tons from Belgium, and 15 tons from Japan.

—◆—

CALUMET & ARIZONA MINING COMPANY produced 9,853,500 lb. of blister and electrolytic copper during September.

THE AMERICAN SMELTING & REFINING COMPANY will, effective Oct. 15, sell its copper, lead, and zinc in the English market through the International Metal Company. The latter organization has appointed the Metal Traders, Ltd., London, its sole representative in Great Britain.

ANDES COPPER MINING COMPANY, including Potrerillos Railway Company, reports net profit for six months ended June 30, 1929, of $7,345,107, after payment of taxes and allowing for other charges, equivalent to $2.05 a share. Net profit for the quarter ended June 30 amounted to $3,530,604, after deducting regular charges, against $3,814,503 in the quarter ended March 31 of the current year.

GOLD PRODUCTION IN ONTARIO for the month of August was valued at $2,802,681, recovered from 342,326 tons of ore, an average of $8.20 a ton, according to the Ontario Bureau of Mines. The Porcupine mines treated 252,509 tons and recovered $1,736,523, an average of $6.90 a ton. This is the largest output for any month of the year to date and is accounted for by an increase in the Hollinger grade. The Kirkland Lake mines treated 89,817 tons and recovered $1,063,999, an average of $11.80. For the eight months to date the gold production amounted to $22,024,000, compared with $21,246,000 for the corresponding period of 1928.

E.&M.J. Weighted Index of Non-Ferrous Metal Prices

100 Is Composite for 1922-3-4

1920	130.92
1921	80.80
1922	93.94
1923	103.43
1924	102.63
1925	111.74
1926	107.74
1927	97.54
1928	99.78

	1927	1928	1929
January	100.46	97.54	106.86
February	100.01	96.73	110.37
March	100.84	96.22	122.71
April	98.63	97.14	116.36
May	96.41	99.05	110.03
June	95.55	100.16	109.66
July	95.42	99.69	109.58
August	97.25	99.85	109.81
September	96.01	100.53	109.29
October	95.36	102.34	.....
November	96.22	103.83	.....
December	98.30	104.28	.....

Golden Cycle Earnings Hold at Steady Level

IN MAKING its quarterly dividend 40c. a share, A. E. Carlton, president of the Golden Cycle Corporation, Colorado Springs, announced that earnings for the six months ended June 30 were $1.22 per share, or about the same as last year. Assets are:

Cash and gold bullion on hand	$1,779,359
Accounts receivable	124,867
Material and supplies	132,503
Prepaid charges	66,240
Office building, income property	241,287
Stocks and bonds	290,427
Total	$2,634,683
Less current liabilities	151,377
Net assets exclusive of mill and coal mines	$2,483,306

Total cash dividends paid to June 30, 1929, amounted to $11,073,300. The company has completed the installation of a flotation unit for the treatment of low-grade ores.

—◆—

Lead Stocks Increase During August

LEAD stocks in the United States and Mexico on Sept. 1 totaled 175,641 tons, against 173,549 tons on Aug. 1, and 156,976 tons on Sept. 1, 1928, according to the American Bureau of Metal Statistics. Stocks of refined lead on Sept. 1 amounted to 69,872 tons, against 66,989 tons a month previous.

Total stocks of lead in the United States and Mexico, by months, since Jan. 1, with a comparison, follow:

	1929	1928
Jan. 1	161,460	156,280
Feb. 1	156,182	157,417
March 1	160,597	167,692
April 1	158,149	173,411
May 1	156,888	161,207
June 1	162,255	159,375
July 1	173,612	163,709
Aug. 1	173,549	158,919
Sept. 1	175,641	156,976

Total intake of lead in ore by United States and Mexican smelters in August was placed at 80,903 tons, which compares with 81,531 tons in July, and 77,095 tons in August, 1928.

Current Statistics of Production and Stocks of Copper, Lead, and Zinc

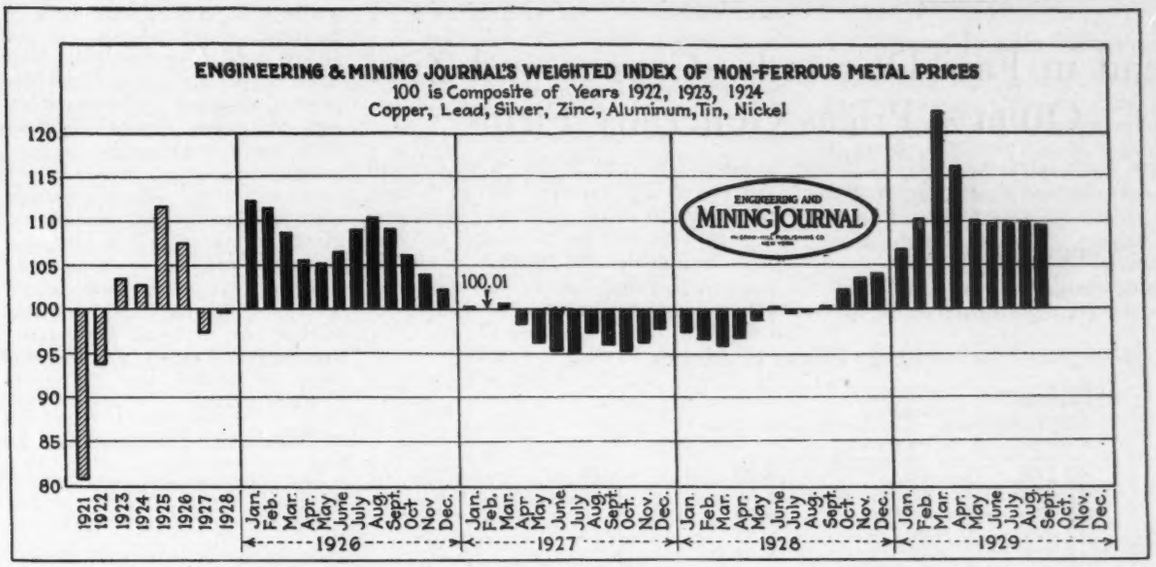
Data from American Bureau of Metal Statistics

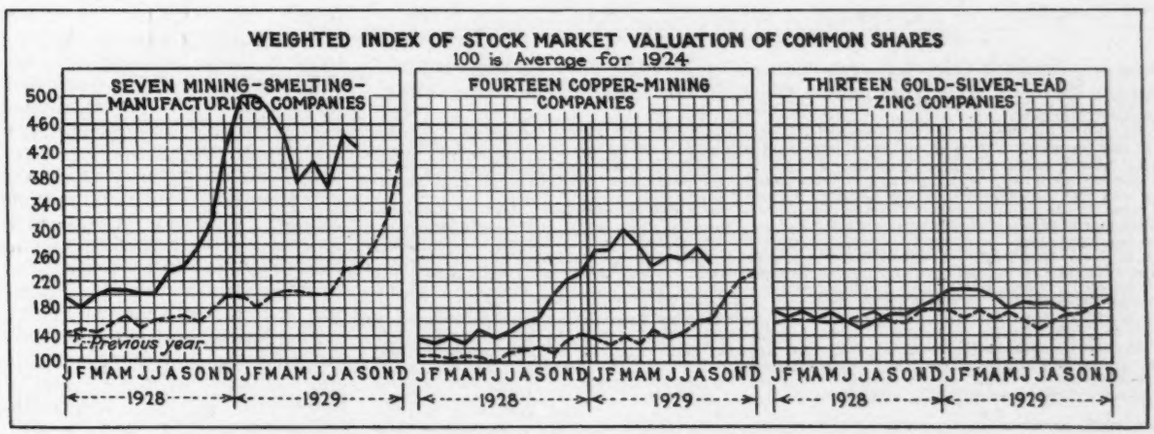
Figures Represent Short Tons

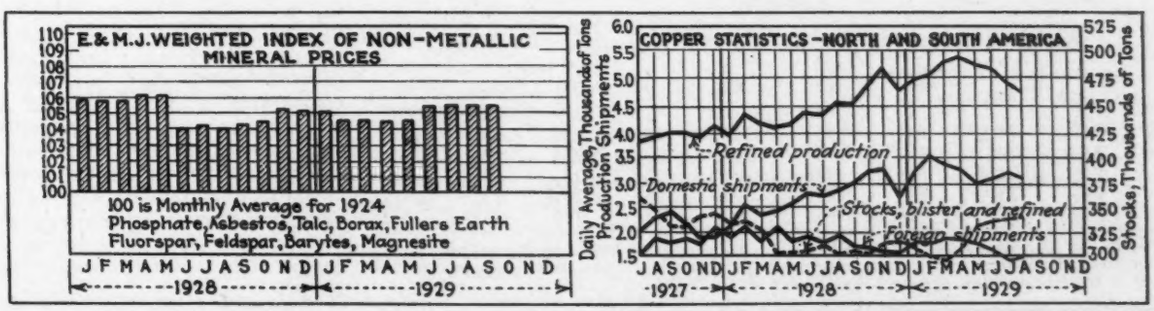
	1927	1928				1929							
COPPER—North and South America	Average	June	July	August	Average	Jan.	Feb.	March	April	May	June	July	August
Production, refined, daily average	4,045	4,367	4,358	4,631	4,448	4,983	5,049	5,276	5,378	5,219	4,630	4,952	4,795
Domestic shipments	68,737	81,436	82,245	83,398	81,955	100,135	98,771	105,860	99,051	93,743	95,258	98,720	96,970
Foreign shipments	53,489	57,067	56,785	60,240	57,185	57,054	50,150	59,946	57,708	55,123	48,461	40,204	45,035
Stocks, blister and refined	335,311	294,172	296,002	309,226	300,771	307,959	296,298	295,309	311,003	332,641	334,621	337,199	346,050
LEAD—United States and Mexico													
Production, smelter, daily average	2,513	2,470	2,219	2,499	2,514	2,656	2,559	2,617	2,720	2,792	2,777	2,723	2,540
Production, U. S. mines, daily average	1,798	1,717	1,570	1,780	1,785	1,891	1,723	2,118	2,083	2,067	1,925	1,881	.....
Imports into U. S. A.	13,451	14,505	14,272	11,699	12,757	22,924	9,551	8,383	7,115	6,944	9,412	12,572	.....
Stocks, smelter and refinery	156,878	162,274	158,919	156,976	160,511	156,182	160,597	158,683	156,888	162,255	173,612	173,549	.....
ZINC—United States													
Production, daily average	1,681	1,694	1,642	1,682	1,693	1,604	1,720	1,790	1,822	1,837	1,708	1,756	1,783
Domestic deliveries	45,811	49,780	49,510	47,050	48,301	47,677	51,057	56,267	56,558	56,614	47,973	46,570	50,610
Exports, slab zinc	3,468	1,709	2,145	2,923	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)	(a)
Exports, ores and dross	4,424	268	221	463	453	545	165	483	308	358	266	537	.....
Stocks	37,602	44,468	42,210	44,416	44,333	45,418	40,620	37,962	34,588	33,826	36,932	44,122	47,833
World Production Rate (Daily Average)													
Copper	4,543	5,215	4,942	5,124	5,236	5,767	5,968	6,219	6,561	6,213	5,820	5,624	5,604
Lead	4,514	4,392	4,170	4,350	4,976	5,037	5,068	5,176	5,418	5,440	5,467	5,277	5,186
Zinc	3,910	4,131	4,013	4,027	4,271	4,231	4,357	4,448	4,537	4,528	4,483	4,388	4,400

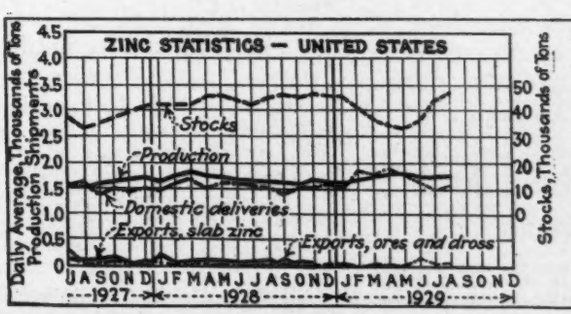
(a) Withheld pending investigation of government reports.

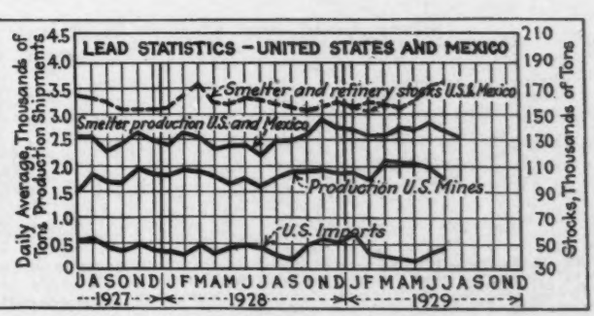
E. & M. J. Statistics of the Mining Industries











The Market Report

Lead in Fair Demand—Copper and Zinc Quiet—Prices Generally Firm

New York, Oct. 9, 1929.—Lead met with fair demand during the week, but trade in copper, zinc and tin was quiet.

Copper Prices Firm

Though business in copper again was below the average in volume, the market continues to hold at 18c. for Connecticut deliveries, and 18⅛c. in the Middle West. Most of the business placed during the week was for November delivery and inquiry in the market points to some substantial buying for this position. October demands of consumers appear to be well taken care of, although some prompt business was done. A little copper sold for January and February delivery. The trade is awaiting publication of the September statistics and most operators look for a reduction in stocks of refined metal of more than 10,000 tons. Against this drop in refined copper an increase in blister holdings is expected. Movement of copper into consuming channels is progressing at a steady rate, owing largely to the sustained activity in wire, cable and brass industries. More copper has been sold for October delivery than for any month this year except March.

Export demand for copper has been moderate, but better than earlier in the month. Sales for export for the month to date are close to 8,000 tons, all of the business being at the unchanged price of 18.30c. per lb., c.i.f. usual European ports.

Daily Prices of Metals

Oct.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
3	17.775	44.125	6.90	6.70	6.80
4	17.775	43.875	6.90	6.70	6.80
5	17.775	44.000	6.90	6.70	6.80
7	17.775	43.750	6.90	6.70	6.80
8	17.775	43.375	6.90	6.70	6.80
9	17.775	43.375	6.90	6.70	6.80
	17.775	43.750	6.900	6.700	6.800

Average prices for calendar week ending Oct. 5, 1929, are: Copper, 17.775c.; Straits tin, 44.154c.; New York lead, 6.900c.; St. Louis lead, 6.700c.; zinc, 6.800c.; and silver, 50.083c.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted.

Quotations for copper are for the ordinary forms of wirebars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight differential. Contract prices for High-Grade zinc delivered in the East are 1@1¼c., depending upon purity, above St. Louis prices for Prime Western.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

Oct.	Copper		Electrolytic	Tin		Lead		Zinc	
	Standard								
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
3	73 11/16	74 7/16	84 1/4	198 7/8	202 3/4	23 3/8	23 1/2	23 7/8	24 3/16
4	73 12/16	74 3/8	84 1/4	198 1/2	202 1/4	23 1/4	23 3/8	23 7/8	24 1/4
7	74 1/8	74 11/16	84 1/4	198 5/8	202 1/2	23 1/4	23 7/16	23 13/16	24 1/4
8	74 11/16	75 1/16	84 1/4	196 1/2	200 1/2	23 1/2	23 7/16	23 7/8	24 1/16
9	74 7/16	74 3/4	84 1/4	196 1/2	200 1/2	23 1/4	23 3/8	23 5/8	23 15/16

Prices for lead and zinc are the official closing prices for the morning session of the London Metal Exchange; prices for copper and tin are the official closing buyers' prices. All are in pounds sterling per long ton (2,240 lb.).

Silver, Gold, and Sterling Exchange

Oct.	Sterling Exchange "Checks"	Silver		Gold London	Sept. Oct.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
3	$4.85 3/16	50	23 1/8	84s 11½d	7	$4.85½	50	23 1/16	84s 11½d
4	4.85 9/16	50 1/8	23 1/8	84s 11½d	8	4.85 9/16	49 5/8	22 15/16	84s 10½d
5	4.85 9/16	50	23 1/8	.....	9	4.85 5/8	49 5/8	22 15/16	84s 11½d

Average: Silver, 49.896c.; Sterling Exchange, $4.85500

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of silver, 999 fine. London silver quotations are in pence per troy ounce of bar silver, basis 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command five-eighths cent premium.

Moderate Demand for Lead

The volume of lead sales has been substantially unchanged for the last three weeks, being between 4,000 and 5,000 tons, aside from contract business. In the week ending today, most of the inquiry has been for carload or slightly larger lots, almost exclusively for prompt shipment, though one large order from a cable company for November shipment was booked. Such demand as there was, was well distributed, with storage battery manufacturers taking rather more than was expected. Statistics indicate that at least an additional 10,000 tons of lead will be bought for October shipment, unless there was overbuying for September. Very little November lead has yet been purchased, except on contract, though producers are now selling freely for that position.

The New York basis price of American Smelting & Refining and other sellers continues at 6.90c., and the St. Louis basis is 6.70c. Independent sellers have not sold as freely as they would have liked. In some instances in the last three days, they have been obliged to accept a concession of 2½ points from the St. Louis price. The tonnage sold at such concessions, however, is not comparable to that marketed by the large producers, whose quotations remain firm. In fact, most of them rather look for the next change in price to be upward, though there is no present likelihood of such a movement with the London quotation so close to import parity, and with a comparatively quiet market.

Corroding grades command the usual premium of $2@$3 per ton.

Zinc Sales Negligible

Dullness was the rule in the zinc market. The little business that was placed went through on the basis of 6.80c. per lb., St. Louis. The virtual deadlock between producers and the large consumers continues, although the general feeling is that galvanizers will have to place a good tonnage before long. Production of zinc in September decreased 2,005 tons, contrasted with August, but stocks gained 5,530 tons.

September statistics released by the American Zinc Institute, in tons of 2,000 lb., follow:

Stock Sept. 1	47,833
Produced	53,285
Shipped	47,755
Stock, Sept. 30	53,363
Shipped from plants for export	1,468
Metal sold, not delivered, Sept. 30	21,800
Total retort capacity, Sept. 30	119,921
Average number retorts operating in September	70,240
Retorts operating, Sept. 30	68,828

The increase in stocks indicates the need of a curtailment in production with present consuming demands.

Cheap Tin Not Attractive

Though tin prices are well below 45c. per lb., being around 43⅜c. for prompt Straits the last two days, bargain hunters have not been in evidence, evidently feeling that conditions are not ripe for any advance. Each day sees only a small tonnage sold, and that in scattering lots to consumers for prompt shipment. Futures command premiums of ¾ to 1c., largely nominal.

Silver Again Weak

The silver market has again weakened in sympathy with the decline of China exchanges. The London price of 22 1/16d. and the New York price of 49⅝c. are the lowest quoted since Aug. 28, 1915, and Nov. 3, 1915, respectively. The closing is uncertain.

Mexican Dollars (old Mexican pesos): Oct. 3d 37c.; 4th 37⅛c.; 5th and 7th 37c.; 8th and 9th 36¾c.

Foreign Exchange

Closing cable quotations on the principal Continental exchanges on Tuesday, Oct. 8, were: Francs, 3.92 1/16c.; lire, 5.23⅜c.; and marks, 23.83¾c. Canadian dollars, 1 7/64 per cent discount.

Other Metals

Quotations cover large wholesale lots unless otherwise specified

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c.

ANTIMONY—Per lb.. duty paid, New York: Chinese brands 8⅜c. per lb. for spot and future shipments. Market quiet. Cookson's "C" grade, spot, 14c.

BISMUTH—Per lb., New York. in ton lots, $1.70. Smaller lots, $1.80 and up.

CADMIUM — Per lb., New York: 80@90c. Steady demand.

IRIDIUM — Per oz., $220@$230 for **98@99 per cent sponge and powder.**

NICKEL—Per lb. ingot, 35c.; shot, 36c.; electrolytic, 35c. (99.9 per cent grade) for single lots of spot metal.

PALLADIUM — Per oz., $36@$38. Small lots bring up to $48. Nominal.

PLATINUM—Official price quoted by the leading interest on small orders for refined metal is $65 per oz. Transactions between dealers and refineries in the outside market are reported at several dollars less.

QUICKSILVER — Per 76-lb. flask, $124@$125. Small lots command the usual premiums.

Prices of Chromium, Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Osmium, Radium, Rhodium, Ruthenium, Selenium, Tantalum, Tellurium, Thallium, Titanium, Tungsten, Vanadium, and Zirconium are unchanged from the issue of Oct. 5.

Metallic Ores

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $15.25@$15.50 for future shipment. China offerings continue light and prices are steady. Bolivian scheelite, $15.50@$15.75. Oct.-Nov. shipment. Western scheelite, $16.50 for Dec.-Jan. shipment.

Antimony, Chrome, Iron, Manganese, Tantalum, Titanium, Vanadium, and Zircon ores are unchanged from quotations in the Oct. 5 issue.

Tri-State Shut Down to Reduce Ore Stocks

Joplin, Mo., Oct. 5, 1929

Blende		Per Ton
High		$47.05
Premium Blende, basis 60%	$44.00@	44.50
Prime Western, basis 60%	43.00@	44.00
Table concentrates, 60%	41.00@	43.00
Flotation concentrates, 60%	39.00@	41.00
Average settling price		44.58
Galena		
High		$88.80
Basis 80% lead		87.50
Average settling price, all lead ore		87.20

Shipments for the week: Blende, 12,146 tons; lead, 1,983 tons. Value all ore the week, $714,300.

No changes have been reported in the price paid for lead ore, but quantities have shifted from one buyer to another in a manner indicating that a premium was paid. Buyers deny advancing the basis price and sellers will divulge no premium offers.

The closing of fifty mines of the larger producing mills this week will probably reduce stocks approximately 6,000 tons. This, together with the reported idle mines in the Butte group of Anaconda, should have a salutary effect in maintaining zinc concentrate prices. With curtailment of the retort output of slab zinc, effective during August, metal stocks should show a marked decrease.

Platteville, Wis., Sept. 28, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$46.25
Lead Ore	
Lead, basis 80 per cent	$87.50

Shipments for the week: Blende, 600 tons; lead, 120 tons.

Platteville, Wis., Oct. 5, 1929

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$46.75
Lead Ore	
Lead, basis 80 per cent	$90.00

Shipments for the week: Blende, 583 tons; lead, 120 tons. Shipments for the year: Blende, 26,253; lead, 1,660 tons. Shipments for the week to separating plants, 1,409 tons blende.

Non-Metallic Minerals

Amblygonite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomite, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Iron Oxide, Lepidolite, Limestone, Magnesite, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystal, Silica, Spodumene, Sulphur, Talc, and Tripoli are unchanged from prices in the Oct. 5 issue.

Metallic Compounds

ARSENIOUS OXIDE (White Arsenic) Per lb., 4c. Demand continues at steady rate and the market presents a firm undertone.

SODIUM NITRATE — Per 100 lb., $2.10 for October delivery.

Antimony Oxide, Calcium Molybdate, Copper Sulphate, Sodium Sulphate, and Zinc Oxide are unchanged from prices in the Oct. 5 issue.

Alloys

FERROMANGANESE—Per long ton, domestic and foreign, f.o.b. furnace or duty paid, port of entry, $105. Spiegeleisen, 19@21 per cent, $34 f.o.b. furnace on carload business.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, $1.45@$1.50, f.o.b. works.

Ferrocerium, Ferrochrome, Ferromolybdenum, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferrovanadium, Nickel Silver, and Yellow (Muntz) Metal are unchanged from prices in the Oct. 5 issue.

Rolled Metals

Copper, lead, zinc, Monel metal, and nickel sheets, and copper wire, are unchanged from prices in the Oct. 5 issue. Ribbon zinc, effective Oct. 7, quoted at 9.50c. lb., against previous price of 9.25c.

Refractories

Chrome Brick, Fireclay Brick, Magnesite Brick, Silica Brick and Zirkite are unchanged from quotations in the issue of Oct. 5.

Iron, Steel, and Coke

IRON—Per gross ton, Valley furnaces, Bessemer, $19; basic, $18.50; No. 2 foundry, $18.50.

STEEL—Base prices per gross ton Pittsburgh, billets and slabs, $35; plates, structural shapes, and soft steel bars, per 100 lb., $1.95.

COKE—Per gross ton, Connellsville furnace, $2.65@$2.75. Connellsville foundry, $3.75@$4.85. Byproduct coke, Ohio and Kentucky (Connellsville basis) $6.50; Buffalo and Detroit, $8.75@$9.

Mining Stocks—Week Ended October 5, 1929

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda Copper	New York	118⅛	108⅜	114⅜	Oc. 11 No. 18 Q	1.75
Andes Copper	New York	53	49⅜	50⅜	Oc. 11 No. 11 Q	0.75
Arizona Com	Boston	1⅛	1⅛	1⅛	Jl. 16 Jl. 31 SA	0.25
Calumet & Ariz	New York	126½	119¼	120½	Se. 6 Se. 23 Q	2.50
Claumet & Hecla	New York	42	40	40	Au. 31 Se. 30 Q	1.00
Cerro de Pasco	New York	93	88⅛	92	Oc. 10 No. 1 Q	1.50
Con. Coppermines	N. Y. Curb	9¼	8⅛	8⅛		
Copper Range	Boston	22⅛	21⅛	21⅛	Se. 14 Oc. 15 Q	0.50
East Butte	Boston	2½	2½	2½	Dec., 1919	0.50
Granby Con	New York	85⅛	79¼	82⅛	Oc. 18 No. 1 Q	2.00
Greene Cananea	New York	177	170	170	Se. 12 Oc. 7 Q	2.00
Howe Sound	New York	61	56	59⅛	Se. 30 Oc. 15 Q	1.00
Hudson Bay	N. Y. Curb	16⅛	16	16⅛		
Inspiration	New York	43¼	37	39⅛	Se. 9 Oc. 7 Q	1.00
Isle Royale	Boston	21⅛	20	20⅛	Au. 31., Se. 30	0.50
Kennecott	New York	83⅜	78⅛	81⅛	Au. 30, Oc. 1 Q	1.25
Magma Copper	New York	68⅛	65⅛	8	Se. 30, Oc. 15 Q	1.25
Mason Valley	N. Y. Curb	2	2	2		
Miami Copper	New York.	41⅛	38	40⅛	Au. 1, Au. 15 Q	1.00
Mohawk	Boston	59⅛	57⅛	57⅛	Jl. 31, Se. 2 Q	2.00
Mother Lode	New York	2⅛	2⅛	2⅛	Je. 13, Je. 29	0.20
Nevada Con	New York	45½	40⅛	43⅛	Se. 18, Se. 30 Q	0.75
Noranda	N. Y. Curb	54	48⅛	48⅛		
Ohio Copper	N. Y. Curb	1⅛	1	1⅛	Sept., 1926	0.03
Old Dominion	Boston	8	7⅛	7⅛	Dec., 1918	1.00
Phelphs Dodge	New York	63	57	63	Se. 4, Oc. 1 Q	0.75
Quincy	Boston	41⅛	40	40	March, 1920	1.00
Roan Antelope	N. Y. Curb	42⅜	39⅛	40		
St. Mary's M. L.	Boston	38⅛	37	37	Fe. 25, Mr. 12	2.00
Seneca Copper	New York	5	4⅛	4⅛		
Shattuck Denn	N. Y. Crb	14⅛	10⅜	12⅛		
Sheritt-Gordon	Toronto	6.35	5.75	6.00		
Tenn. C. & C.	New York	17⅛	16⅛	16⅛	Au. 31, Se. 16 Q	0.25
United Verde Ex	N. Y. Curb	....	....	16⅛	Oc. 2, No. 1 Q	1.00
Utah Copper	New York	....	....	325	Se. 18, Se. 30 Q	4.00
Waite-Ack.-Mont.	Toronto	5.15	4.00	4.00		
Walker Mining	Salt Lake	5.55	5.50	5.50		
Wenden Copper	N. Y. Curb	....	....	*93¼		
LEAD, ZINC, SILVER						
Ahumada Lead	New York	1⅛	1⅛	1⅛		
Amer. Z. L. & S.	New York	20	13⅛	18	May, 1917	1.00
A. Z. L. & S., pfd.	New York	98⅛	85⅛	90⅛	Se. 19, Ox. 1 Q	1.50
Bunker Hill & S.	N. Y. Curb	....	....	145⅛	Se. 27, Ox. 5 MX	0.75
Butte Cop. & Zn.	New York	4⅛	3⅛	4		
Butte Cop. Con	Boston Curb	*68⅛	*50	*56½		
Butte & Sup	New York	7⅛	6⅛	6⅞	Je. 14, Je. 29 Q	0.50
Callahan Zn-Ld	New York	2	1⅞	1⅞	Dec., 1920	0.50
Chief Consol	Salt Lake	3.05	2.75	2.75	Fe. 1, 1918 K	0.10
Consol. Ld. & Zn. "A"	St. Louis	10	9⅛	10	Se. 20, Oc. 1 Q	0.25
Constitution	Spokane	*44⅛	*42⅛	*44		
Dayrock	Spokane	3.15	3.00	3.00	Je. 20, Je. 30	0.03
Dickens Consol	Spokane	*7⅛	*7⅛	*7⅛		
Eagle-Picher	Cincinnati	16⅛	16	16	Se. 30, Oc. 15 Q	0.20
Eagle-Pich., pfd.	Cincinnati	103	102	102	Se. 30, Oc. 15 Q	1.50
Erupcion	Boston Curb	....	....	*12	Jan. 1, 1928	0.07⅛
Eureak Bullion	Salt Lake	*88	*80	*80		
Evans-Wallower	N. Y. Curb	17⅛	14⅛	17⅛		
Evans-Wal., pfd.	N. Y. Curb	....	....	80	Je. 20, Jl. 1 Q	1.75
Federal M. & S.	New York	....	....	2.37	June, 1927	10.00
Fed. M. & S., pfd.	New York	....	....	99	Au. 23, Se. 16 Q	1.75
Gladstone	Spokane			*4⅛		
Golconda	Spokane	*82	*77⅛	*77⅛	Je. 15, Jl. 1	0.02
Grandview	Spokane	*30	*26⅛	*26⅛		
Hecla Mining	N. Y. Curb	17	16⅛	16⅛	Au. 15, Se. 15 Q	0.25
Highland-Surprise	Spokane	*12⅛	*11	*12⅛		
Jack Waite	Spokane	*13⅛	*12⅛	*13		
Kootenay Florence	Spokane	*11	*10⅛	*11		
Lucky Jim	Spokane	*12⅛	*11⅛	*12		
Lucky Tiger-C	Kansas City	....	....	....	Oc. 10, Oc. 20	0.02⅛
Mexican Premier	Spokane	2.24	2.20	2.24		
National Lead	New York	190	172	180	Se. 13, Se. 30 Q	1.25
Natl. Lead, pfd. A	New York	139⅛	139	139	Au. 30, Se. 14 Q	1.75
Natl. Lead, pfd. B	New York	116⅛	116	116⅛	Oc. 18, No. 1 Q	1.50
N. J. Zinc, new	N. Y. Curb	84⅛	80⅛	81	Oc. 21, No. 9 Q	0.50
New Quincy	Salt Lake	2.05	1.75	1.87⅛	Se. 20, Se. 30 Q	0.10
Noble Five	Spokane	*60	*59⅛	*59⅛		
North Lily	Salt Lake	5.00	4.55	4.65	Jl. 16, Jl. 20 Q	0.25
Park Bingham	Salt Lake	7.50	7.00	7.00		
Park Utah	New York	4⅛	4	4	Dividends suspended	
Pend Oreille	Spokane	4.00	4.00	4.00		
Rico Argentine	Salt Lake	*28	*25	*25	No. 30, De. 15 Q	0.03
Ruth-Hope	Spokane	*34	*33	*34		
St. Joseph Lead	New York	66	62	63	Se. 10, Se. 20 QX	0.75
Sherman Lead	Spokane	*66⅛	*65	*66⅛		
Silver King Coa	Salt Lake	12.25	12.00	12.25	Se. 20, Oc. 1 Q	0.25
Silversmith	Spokane	*8	*7⅛	*7⅛	Oct., 1926	0.02
Sunshine Mining	Spokane	5.70	5.10	5.70	Se. 10, Se. 20 Q	0.05
Tamarack-Custer	Spokane	*56	*52	*56	Sept., 1924	0.25
Tintic Standard	Salt Lake	12.50	12.37½	12.37½	Se. 17, Se. 20 X	0.30
Tonopah Belmont	N. Y. Curb	⅛	⅛	⅛	Oct., 1925	0.05
Treadwell-Yukon	Toronto	8.25	7.50	8.00		
United Zinc Smg	N. Y. Curb	....	....	*68⅛		
Utah Apex	Boston	5⅛	2⅛	4	My. 15, Je. 1	0.25
Utah Met. & Tun	Boston	*95	*90	*90	Dec., 1927	0.30
Whitewater	Spokane	*40	*35	*40		
Yellow Pine	Los Angeles	....	....	*8	Dec., 1925	0.04
GOLD						
Alaska Juneau	New York	8⅛	7⅛	8⅛		
Barry-Hollinger	Toronto	*21	*18	*19		
Central Manitoba	Toronto	*27	*25	*25		
Cresson Consol	N. Y. Curb	*62⅛	*43⅛	*50	Se. 30, Oc. 10 Q	0.02
Dome Mines	New York	9	8⅛	9	Se. 30, Oc. 21 Q	0.25
Golden Cycle	Col. Springs	†1.67½	†1.62½	....	Au. 31, Se. 10 Q	0.04
Hollinger	Toronto	5.60	5.25	5.45	Se. 20, Oc. 7 FW	0.50
Homestake	New York	86⅛	85½	85½	Au. 20, Au. 26 H	0.50
Kirkland Lake	Toronto	*59	*50	*50⅛		
Lake Shore	Toronto	21	20	20⅛	Je. 1, Je. 15 Q	0.20
McIntyre Porcupine	New York	13⅛	13⅛	13⅛	Au. 1, Se. 2 Q	0.25
Portland	Col. Springs	†*7⅛	†*6⅛	....	April, 1927	0.02
Rand Mines	New York	....	....	35⅛	Au. 21, 29 A.s.	1.51
Siscoe	Toronto	1.00	*67	*82		
Sylvanite	Toronto	*75	*65	*75		
Teck-Hughes	Toronto	5.55	5.00	5.45	Jl. 18, Au. 1	0.15
Tom Reed	Los Angeles	*60	*60	*60	Dec., 1926	0.02
Unity Gold	N. Y. Curb	....	....	1⅛		
Vipond Consol	Toronto	*67	*55	*62	April, 1927	0.03
Wright-Hargreaves	Toronto	1.50	1.35	1.42	Oc. 16, No. 1	0.02⅛
Yukon-Alaska	N. Y. Curb	....	....	35⅛		
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	16	15⅛	15⅛		
Castle-Trethewey	Toronto	*31	*30	*30		
Consol. Cortez	N. Y. Curb	*12⅛	*6⅛	*6⅛		
Dolores Esperanza	N. Y. Curb	45	40	40	July, 1923	0.05
Keeley	Toronto	*49	*45	*45	Mr. 15, 1928	0.04
Mining Corp	Toronto	4.00	3.55	3.80	My. 30, Je. 13	0.12⅛
Montana-Mines Corp.	Spokane	*51	*48⅛	49⅛		
N. Y. & Hond. Ros.	N. Y. Curb	15⅛	15⅛	15⅛	Jl. 27, Jl. 27 QX	0.50
Nipissing	N. Y. Curb	2⅛	1⅛	2⅛	Se. 26, Oc. 21 Q	0.07½
Premier Gold	N. Y. Curb	1⅛	1⅛	1⅛	Se. 12, Oc. 3 Q	0.06
Tonopah Exten	N. Y. Curb	....	....	*10	April, 1925	0.05
Tonopah Mining	N. Y. Curb	....	....	2⅛	Se. 30, Oc. 21	0.07½
United Eastern	N. Y. Curb	....	....	*25		
Yukon Gold	N. Y. Curb	....	....	*93⅛	June, 1918	0.02
IRON AND STEEL						
Bethlehem Steel	New York	118	110⅛	118	Oc. 18, No. 15 Q	1.50
Beth. Steel, pfd, 7%....	New York	125⅞	125⅛	125⅛	Se. 6, Oc. 1 Q	1.75
Cleveland-Cliffs	Cleveland	99	97	99	Se. 5, Se. 15 Q	1.00
Colo. Fuel & Iron	New York	64⅜	59⅛	63		
Colo. F. & I., 1st pfd.	New York	65⅜	59⅛	63	Au. 10, Se. 26 Q	2.00
Great Northern Iron	New York	111⅛	107⅛	109	Dec. 15 K	2.00
Inland Steel	New York	99⅛	94	99⅛	Au. 15, Se. 1 Q	1.87½
Republic I. & S.	New York	130⅜	115⅛	125⅛	My. 11, Je. 1 Q	1.00
Republic I. & S. pfd.	New York	110⅛	110⅛	110⅛	Je. 12, Jl. 1 Q	1.75
Sloss-Sheffield S. & I.	New York	50⅛	48⅛	48⅛	Mr. 11, Mr. 20 Q	1.50
Sloss-Sheff. S.&I., pfd.	New York	....	....	74⅛	Se. 20, Oc. 1 Q	1.50
U. S. Steel	New York	226	206⅛	217⅞	Au. 29, Se. 28 Q	1.75
U. S. Steel, pfd.	New York	143⅛	143	143	Au. 5, Au. 30 Q	1.75
Virginia I. C. & C.	New York	20	20	20	Jan., 1924	1.50
Virginia I.C.&C., pfd.	New York	....	....	43	Jl. 16, 1928 SA	2.50
MISCELLANEOUS						
Aluminum Co. of Am.	N. Y. Curb	425	355	370		
Alum. Co. of Amer., pf.	N. Y. Curb	107	106⅛	106⅛	Mr. 15, Ap. 1 Q	1.50
American Metal	New York	73	66⅛	68⅛	Au. 21, Se. 1 Q	0.75
Amer. Metal, pfd., 6%	New York	126½	125	126	Au. 21, Se. 3 Q	1.50
Amer. Sm. & Ref.	New York	114⅛	106⅛	110⅛	Oc. 11, No. 1 Q	1.00
Amer. Sm. & Ref., pfd.	New York	135⅛	135	135	No. 1, De. 2 Q	1.75
Ang. Ch. Nitrate	N. Y. Curb	34⅛	33	33		
Asbestos Corp	Montreal	5	4	4⅛	Jan., 1926	1.50
Asbestos Corp., pfd.	Montreal	17	15	17	De. 31, Ja. 15 Q	1.75
Consol. M. & S.	Montreal	390	390	390	Je. 29, Jl. 15 SAX	6.25
De Beers Consol.	New York	....	....	21	Jl. 23, Jl. 26 Q	0.96
Federated Metals	N. Y. Curb	34⅛	33	33	Oc. 3, Oc. 11 Q	0.25
Freeport Texas	New York	45	42⅛	43	Oc. 15, No. 1 Q	1.00
Int. Nickel Can.	New York	58⅛	48⅛	53⅛	Au. 31, Se. 30 Q	0.25
Int. Nickel, pfd.	New York	120	120	120	Se. 28, No. 1 Q	1.75
Mayflower Assoc.	N. Y. Curb	100⅛	95	96		
Metal & Mining	N. Y. Curb	19	17	18	Se. 21, Oc. 1	0.30
Newmont	N. Y. Curb	224⅛	205⅛	214	Se. 30, Oc. 15 Q	1.00
Patino M. & E.	New York	37⅛	36	37⅛	Au. 31, Se. 28 A.s.	0.97
So. America G. & P.	N. Y. Curb	2	1⅞	2		
Texas Gulf Sulphur	New York	68⅛	65⅛	66⅛	Se. 2, Se. 16 Q	1.00
U. S. Sm. R. & M.	New York	50	46	48	Oc. 7, Oc. 15 Q	0.87½
U. S. Sm. R. & M., pfd	New York	53⅛	52	52⅛	Oc. 7, Oc. 15 Q	0.87½
Vanadium Corp	New York	85⅛	75	81	Au. 1, Au. 15 Q	0.75

Toronto Standard Stock Exchange, Toronto, courtesy the Arthur E. Moysey Co.; Salt Lake Stock Exchange, courtesy J. A. Hogle & Co. and Logan & Bryan, New York; Standard Stock Exchange, Spokane, courtesy Pohlman Investment Company

*Cents per share. †Bid or asked. Q, Quarterly. A. Annually. SA, Semi-annually. M, Monthly. BM, Bimonthly. FW, Four weeks. K, Irregular. I Initial. R, Respumption. X, Extra. The first date given is that of the closing of the books; the second that of the payment of the dividend. A.s., American shares.

LONDON QUOTATIONS—WEEK ENDED September 24, 1929

	High	Low	Last	Date	Amount
Alaska Mexican ($5)	20/—	20/—	20/—		
Alaska Treadwell ($25)	62/6	62/6	62/6	Nov., 1926	4 p.c.
Aramayo Mines (25 frs.)	57/6	56/3	57/6	Aug., 1929	5 p.c.
Burma Corpn. (10 rupees)	18/1½	17/3	17/10½	July, 1929	9 annas*
Bwana M'Kubwa (5s)	32/6	28/—	30/4½		
Camp Bird (2s)	2/7½	2/3	2/4½	April, 1928	16⅔ p.c.
El Oro (5s)	2/—	2/4½	3/—	Nov., 1924	2½ p.c.*
Frontino & Bolivia (£1)	6/10½	6/10½	6/10½	Jan., 1928	3½ p.c. (e)
Mexican Corpn. (£1)	17/1½	16/4½	16/6		
Mexico Mines of El Oro (£1)	5/1½	3/1½	5/1½	Dec., 1926	3½ p.c.*
Mount Isa (£1)	39/3	38/1½	38/1½		
N'Changa Copper Mining (£1)	71/3	65/—	67/6		
Oroville Dredging (4s)	1/6½	1/6½	1/6½	Nov., 1928	31¼ p.c.
Rhodesian Congo Border (£1)	200/—	90/—	197/6		
St. John del Rey (£1)	18/—	17/4½	17/9	April, 1929	7½ p.c.
San Francisco Mines (10s)	35/9	34/9	35/9	June, 1929	15 p.c.
Santa Gertrudis (£1)	10/3	9/7½	9/9	July, 1929	7½ p.c.
Selukwe (2s. 6d.)	7/9	6/3	6/6	April, 1917	6¼ p.c.
S. Amer. Copper (2s)	3/—	2/7½	2/9	Nov., 1917	75 p.c.
Tanganyika (£1)	60/—	56/3	59/4½	July, 1929	7½ p.c.
Union Miniere du Haut-Katanga (Brussels)	11,785	11,575	11,585	April, 1929	300 fr. (‡)

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian francs and free of taxation. e—on original £1 shares.